The Social Contract

Vol. XII, No. 4 Summer 2002

Highlights

Lindsey Grant introduces a selection of essays on population growth, food production, and energy by the well-known scholars, David and Marcia Pimentel.

This year's Kansas drought leads William Dickinson to consider the prospect of conflicts over water that are beginning in parts of the world.

Mike Cutler reflects on his career as an agent in the INS and puts forth some ideas for needed changes.

From Australia, sociologist Katharine Betts discusses the policy ramifications of multiculturalism as a tenet of belief.

Mark Wegierski writes about recent policy trends in Canada.

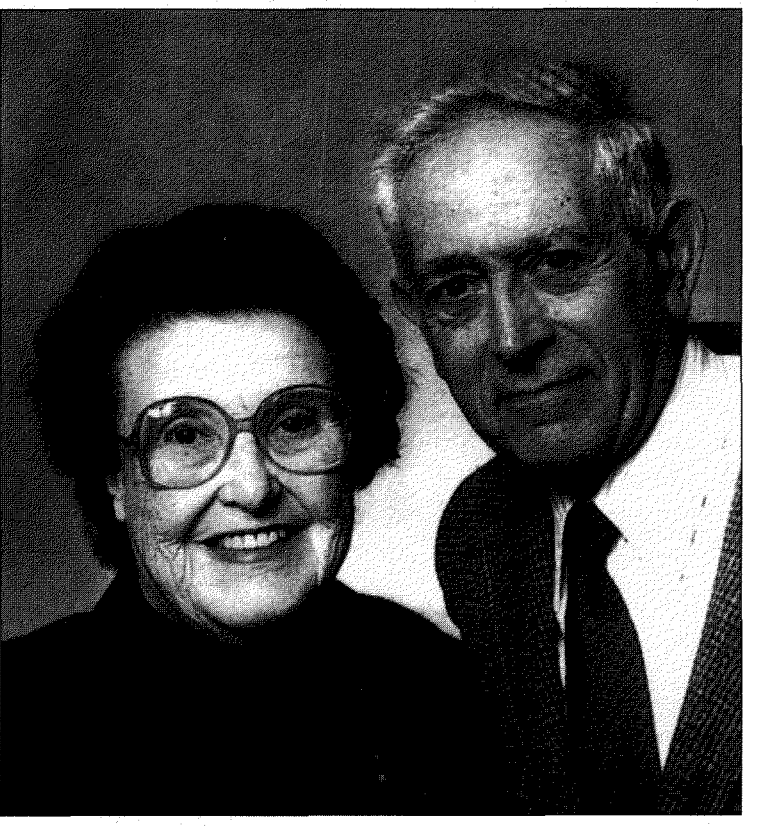
Carl Horowitz provides a double review of books about the Russian mafia establishing itself in the United States.

Craig Straub takes a critical look at Lomborg's *The Skeptical Environmentalist.*

Robert Kaplan's book on *Warrior Politics* is reviewed by Mark Wegierski.

People, Energy, Food Production

Studies by David and Marcia Pimentel



David and Marcia Pimentel

John Attarian analyzes various studies on the prospect of finding more oil. The end of 'cheap' oil is close at hand and the implications must be faced. ***See page 276.***

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About THE SOCIAL CONTRACT

The English philosopher John Locke, whose thinking helped inspire the American revolution, said that society should be governed by an understood set of values he termed "the social contract." Under the social contract, governments have obligations to their citizens, and citizens have responsibilities to society.

Most public issues are basically moral and ethical ones. What is the right thing to do? How do we decide what we think is right? When "rights" collide, which ones take precedence? The concept of the social contract helps us sort out the difficult issues confronting American society today and helps us find balance.

Each quarter THE SOCIAL CONTRACT journal examines trends, events, and ideas that have an impact on America's delicate social fabric. Key topics addressed by this journal:

- *Human population issues, including absolute size, rate of growth, and distribution. Do cherished American ideals prosper or suffer through further population growth?*
- *Immigration issues. In order to best facilitate meeting the highest goals of the American people, (1) how many immigrants should we admit? (2) who should be admitted? and (3) how can we humanely enforce the rules?*
- *Language, assimilation, culture, and national unity considerations. What are shared values necessary to the maintenance of our social contract?*
- *The balance of individual rights and civic responsibilities. Since the previous issues are so often framed in terms of rights, what are the balancing obligations?*
- *Other nations' efforts at creating and guarding their own social contracts. What practical insight can be gained from observing the failures and successes in nation-building by other societies?*

THE SOCIAL CONTRACT explores these complex and interrelated issues with articles, essays and book reviews that vary greatly in outlook and philosophy. We encourage a wide spectrum of opinion as we publish contributions from many vantage points. The opinions expressed by the writers are not necessarily those of the editors or publisher.

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THE SOCIAL CONTRACT

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A Note from the Editor

How many Americans can we sustain... and with what standard of living?

Ten years ago, Negative Population Growth asked a panel of specialists if the United States population had grown too large and, if so, could an optimum population size be identified and achieved? NPG further asked for suggestions on how to confront the existing problems facing our country.

Some answers to these questions were published in a book, *Elephants in the Volkswagen: Facing the Tough Questions About Our Overcrowded Country* (New York & Oxford: W. H. Freeman, 272 pp., 1992) edited by Lindsey Grant, a former Deputy Assistant Secretary of State for Environmental & Population Affairs. After exploring the concept of optimum population – a term coined by Sir Julian Huxley – the first paper in the symposium was, "Land, Energy & Water: Constraints Governing Ideal U.S. Population Size," by David and Marcia Pimentel. This is an essay that has haunted my thinking about population-related issues ever since I first read it. After examining how our environment has been degraded and nonrenewable resources consumed, they came to the conclusion that current standards of prosperity could not be sustained in the future without a major reduction in U.S. population size:

If the U.S. population wishes to continue to enjoy its current high level of energy use and standard of living and prosperity, its ideal population should be between forty and one hundred million people. With sound energy conservation practices and a drastic reduction of energy use per capita to less than one-half current usage, it might be possible to support the current population. One choice requires a significantly lower population level and the other results in a dramatic reduction in the standard of living because of the resource needs of the larger population.

At present levels of fertility and migration, the U.S. population will rise by more than one-half by 2050... Comparisons to China clearly show why the U. S. will be unable to maintain its current level of prosperity and high standard of living, which are based on its adequate fertile land, water, energy, and biological resources.... If the current population level is sustained, a drastic reduction in standards of living will follow.

If the Pimentels are right – and I have seen no convincing argument that they are not – then we should be working to make the transformation to a smaller U.S. population. This would include an end to mass immigration. In answer to the question: How many people should we admit each year? I often turn to Garrett Hardin's reply:

I know of no thoughtful person who would (if he could) stop all immigration. The benefits of variety, of periodic fresh infusions of new peoples and new ideas are real. No adventurous, lively nation wants to forgo them. But how many immigrants are needed to secure these benefits? A thousand per year? Ten thousand? Surely no more.
(G. Hardin, "Smokescreens and Evasions," in *Naked Emperors: Essays of a Taboo-Stalker*. Los Altos, CA: William Kaufmann, Inc., 1982.)

In this issue we are pleased to include an interview with Professor Pimentel and key essays by David and Marcia Pimentel. Special thanks go to Lindsey Grant for helping organize this feature, as well as to John Rohe for conducting the interview.

WAYNE LUTTON, PH.D.
Editor

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Letters to the Editor

EDITOR:

Reference is made to "An India/Pakistan War. It could come from unbalanced population growth." by Donald A. Collins, *The Social Contract*, Spring 2002.

I have to agree with so much of what Don Collins wrote. The term "rogue males" as applied to "surplus young males" is unfortunate, but is probably aptly descriptive. From a strictly layman's observations of nearly 30 years in and around Asia, the imbalance of population, both in absolute and gender-mix terms, has to derive in part from cultural and relatively peaceful antecedents. But, mostly, it is the extraordinary improvements in healthcare of infant, child and mother, in the past century, that have allowed such a global explosion ... through pure survival. Additionally, when sons are born early in a marriage, often *any* effort is used to limit the preponderance of excess offspring, especially in the middle classes, however that is measured. But if daughters are the initial issue, then major conjugal efforts are made for sons, heirs, and name bearers to follow ... even (still) in Western society, this continues; (e.g., *three* of my neighbouring families, with two girls initially, expanded their families to third born sons.)

So where does that leave us? I was in Lahore for the 1971 Indo-Pakistan War (a rather pathetic affair though I was both strafed and in a house hit by ack-ack fallout) and, in my view, any future encounters will be either territorial border clashes or religious instigations; not ideological. Indeed, on a global basis, I think most "old fashioned" ideological warfare is just that, old fashioned and redundant, save in a few isolated outbursts (e.g., Nepal and Mindanao just now, but also Taiwan and the PRC, a more serious, ever present threat, however remote may that be). Much more unsettling are these "rogue males" of which Mr. Collins writes and their almost freelance activism in almost any part of the globe. They are inventive, determined and, let it be said, courageous, if misguided or downright wrong. It is these bored and restless "loose cannons" who might release killer biochemicals or fire "small" and selectively destructive nuclear devices. Only CIA type intelligence will overcome that threat in the short term and the U.S. will likely have to buy that intelligence, even though such a practice may be distasteful.

A hundred and thirty years ago, like Rome and others before it, the British Empire began its decline brought on by arrogance and simply the tide of history. It is now that the U.S. must avoid a similar arrogance of "knowing what is best." Allowing other nations to evolve in *their* ways, along *generally* acceptable lines and at *their* own pace, are all essential, even if the model is not what Congress or the President and his appointees wholly endorse. It is also essential to listen to *their* needs. Social aid (meaning financial aid predominantly) will help extensively along this road of development ... not military spending. Included in this must be a containment of global over-population, along with those "rogue males," as the imbalance remains a critical issue. Presently, there appears to me confused, mixed messages on reproductive/family planning health, though I don't suppose there will be many within the poor masses which understand this.

The evidence and conjecture are indicating a powerful linkage between population imbalances and economic underdevelopment, but also emphatically there is the linkage with peace, perhaps with a capital "P" and (in)stability.

Yours sincerely,
PHILIP GETHIN-JONES
Wilton, Connecticut

[*Editor's note: Mr. Gethin-Jones adds: "I was an international banker (British) (1966-1991), principally in Asia (India, Pakistan, Malaysia, Thailand, Japan and Hong Kong) and Group CFO/Finance Director of a Hong Kong Chinese company (1991-1996). I have now retired to the U.S. I serve on the board of a leading U.S. non-profit reproductive health and HIV/AID research organization, serving less-developed nations, but continue my interest in and advice on international affairs.*"]

EDITOR:

I'm glad that Joe Fallon has written up a complete analysis and report on the very interesting meeting featuring Stephen Steinlight that was sponsored by the Center for Immigration Studies in New York City in November 2001 (*The Social Contract*, Vol. XII, No. 3, Spring 2002, page 231). Unfortunately, Mr. Fallon has misrepresented one of my remarks to Steinlight during the question period. According to his account, Steinlight said that Patrick Buchanan is an anti-Semite, and I then challenged him "to cite even one quotation to substantiate that charge," which Steinlight could not do.

That's not exactly what happened. Here is an excerpt from my notes that I wrote down the day of the meeting:

"I asked Steinlight from the floor: 'You've called immigration restrictionists abominable, racist and dangerous, but when Mark Krikorian asked you what specifically you found objectionable about them, you said that it was that they didn't come clean about their own identity politics. Is that all you mean by abominable and racist?' Steinlight gave an evasive answer.

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"I asked him: 'Can you name anything Buchanan has said on immigration that's racist and dangerous?' He replied that he didn't have any quotes at hand, but that Buchanan was an anti-Semite. This was changing the subject. Joseph Fallon who was at the meeting pointed out to me afterward that if Steinlight really knew Buchanan to have said something so awful, he would have remembered it and been able to quote him."

I particularly want to clear up this mistake since, as I wrote in an article at Front Page Magazine this past April, Buchanan's recent articles in which he has demonized Israel for defending itself from suicide bombers and has made other leftist-style arguments against Israel that he would despise in other situations have persuaded me, to my great sadness, that Buchanan is indeed (as others have insisted for years) driven by an anti-Jewish animus. However, though I had not yet come to that definite conclusion as of November 2001, I still would not have challenged Steinlight on that point, given the many well-known charges of anti-Semitism that have been made against Buchanan over the past ten years.

Sincerely,
LAWRENCE AUSTER
New York City

Letters to Other Editors

The *Washington Post* on March 24 featured an article by staff reporter Hanna Rosin, framed by the title, "Snapshot of An Immigrant Dream Fading." It seemed to this writer that throughout the compassionate article was the underlying notion that one may be selective with respect to which laws one will obey.

In the case of Ansar Mahmood, the Pakistani immigrant who had broken a law by helping an undocumented friend from Pakistan obtain an apartment, reporter Rosin passionately implied that because such an action is a "common favor" in the immigrant network, Mahmood should not have been charged with breaking the law. An interesting, empathic point of view, especially in the case in point, so touchingly presented by the writer.

However, given that Mahmood's predicament as presented in the article was heart-rending, it should not be easily dismissed [since] it raises the larger issue of selective enforcement and obedience of the law.

Is it OK to break the speed limit because most other drivers "commonly" do so; to run caution lights because most other cars commonly do so; to break North Carolina's law against unmarried co-habitation because so many other heterosexual couples commonly do so; to shelter alleged bomber Rudolph because he is against abortion and meets the criteria of a sub-cultural "good ol' boy"; or to drink and drive because so many other drinkers commonly do so; and on and on ad nauseam?

Regardless of what one thinks about the apparently pathetic plight of Mahmood and other immigrants who break our laws, one must nevertheless place these and other violations ... into the larger contact of selective obedience or enforcement of the law. This has become a grave issue in today's multicultural society where millions of new arrivals have not been brought up on traditional American values.

If "peace" in the social sense, as Benito Juarez once said, is *respecting another's rights* then however contradictory some of them may seem, all laws on the books must be obeyed — even the ones we believe to be heartless, stupid, unfair, or all of the above.

People cannot arbitrarily choose which laws they will obey and which they will not. Even in the pitiable case of Mahmood, one must reluctantly come down on the side of enforcing the law, regardless of who you are or where you come from. [This is] a street maxim which should apply equally to law-breakers and law-enforcers.

DENOS P. MARVIN
Laurel Springs, Maryland

[The following Letter to the Editor was published in the Fort Collins *Coloradoan* on June 30, 2002:]

Re: U.S. Workers In A Bind

Hewlett-Pachard Co., has cut 10,000 jobs and plans 15,000 more. Agilent has cut 8,000. Motorola has laid off 43,000. Yet while all this is going on, Congress has a special program, H- 1B, to bring in foreign high-tech workers: 195,000 last year; 195,000 this year; and next year, 195,000. So we're in a recession and the electronics industry has massive layoffs. Companies cutting jobs don't do much hiring. In addition to the normal unemployment levels there's lots of fresh-cut workers looking for jobs. Why then does Congress continue to bring in foreign workers under H-1B visas? This can only make the task of finding a new job more difficult for those who have been laid off. Is that what Congress wants? Perhaps Congress doesn't understand the impact of its own programs. More likely, they are simply indifferent to American workers. While Congress is embracing aliens, they've turned their back on Americans. They've even made it a crime to hire Americans exclusively. Watch on the Fourth of July, I bet Congress will pretend to be patriotic.

PERRY LORENZ
Fort Collins, Colorado

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The Pimentels

Holism and science

by Guest Editor Lindsey Grant

Perhaps, years hence, the principal failure of twentieth century science will be recognized as its general failure to reconcile holism – the recognition that everything is connected, but frequently in vague and arcane ways – with the demand of the scientific method that lines of inquiry be sharply delimited and defined so as to permit scientific challenge

For the scientist, the path of caution (if not of enlightenment) is to stay within the narrow edges of his discipline. One can keep up with the literature and avoid the ultimate humiliation of publishing a paper that colleagues can attack for failing to take note of some recent development in his or her field. And, because the scientific literature is expanding fast, disciplines tend to become more and more narrowly defined.

The same process leads the cautious to offer solutions only within their discipline. Human population growth (my area of interest) is the most vivid illustration of the point I am making. Since its effects have been so pervasive, one might reasonably expect that it would be recognized as a cause of many of the problems scientists are investigating. And an effort to influence population growth might often be the solution to the problem, or part of it. Does it happen that way in most scientific research? Hardly. For some years, I kept an informal tally of scientific articles (mostly from *Science*) in which human population change was prima facie a source of the problem. I marked those articles "zip re pop" that either (a) failed to identify it as a cause or (b) having identified it, failed to suggest that action on population growth could be part of the solution. My plan was to write "pop!" on articles that made both connections, but I literally almost never had the chance to bestow that accolade. Scientists, like many others, seem compelled to treat population growth as an independent variable to which they must adjust rather than as a human activity that can be addressed.

The price for this insularity is irrelevance. Reality does not observe disciplinary boundaries. Timidity has sidelined scientists when governments, in their rare moments of lucidity, have undertaken to deal with the real problems they face. Under President Nixon's leadership, the U.S. Government addressed the implications of population growth in the United States and in the less developed countries (LDCs). The domestic effort fizzled out, but in the following decades (with setbacks in the Reagan years and the 1990s), the United States played a major role in educating others about the problem, convincing them of its importance, and helping them to promote family planning. Human fertility has indeed declined in much of the third world, and with that decline comes the beginning of hope. The United States can claim some of the credit for the progress. But U.S. scientists were not leading that charge. A review of U.S. scientific demographic literature in the past forty years would lead us through mind-numbing mountains of detailed and inconclusive studies of the reasons women have children, and very little about the ramifications of population growth itself.

The general insularity of scientific research defies the advice of scientific leaders. Several leading scientists, including at least two Presidents of the American Association for the Advancement of Science (AAAS), have pleaded for more inter-disciplinary research, and specifically for a willingness to take on population growth. All the major national and regional multi-disciplinary research organizations in the world have identified population growth as a central danger to human welfare. I think that the

Lindsey Grant *is a former U.S. Deputy Assistant Secretary of State for Environment and Population and author of several books including* Elephants in the Volkswagon, Juggeranut: Growth on a Finite Planet, *and* Too Many People: The Case for Reversing Growth.

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unwillingness of researchers at the bench level to heed that advice is a product of the structural organization of academia; but that is another topic, and I am not the one to address it.

There is a short honor role of scientists who defy my generalization. From memory, let me mention just a few: Kingsley Davis, Al Bartlett, Garrett Hardin, Henry Kendall, Paul and Anne Ehrlich – and an entire generation of young scientists whom they trained – Lester Brown and the Worldwatch Institute, Lincoln Day, Norman Myers, E.O. Wilson, Leon Bouvier.

Engaging Other Disciplines

Agriculture is the central point where expanding human populations encounter the limits of natural systems. It has reshaped more of the earth's surface more profoundly than any other human activity. The primary goal of agronomy is regularly described as promoting crop yields so as to make it possible to feed a growing population on a land base that has nowhere to grow. Agronomists almost never see it within their purview to suggest that the problem is not simply one of yields; it is the twofold one of bringing demand – population growth and eating habits – into balance with ecologically sustainable yields. And rare indeed is the demographer who, having described population growth, is willing to suggest that it may have consequences for human nutrition.

Poets and writers have described an idealized agriculture in balance with nature at least since Roman times. In the United States, names like Louis Bromfield and Aldo Leopold come to mind. But scientists feel free to ignore them because they are not speaking the language of science.

Geographer Vaclav Smil, in Canada, called attention to what should have been obvious to all of us: that because of commercial agricultural fertilizers, human activity is introducing more nitrogen compounds into the biosphere every year than all natural processes. He thus set in motion an endless series of questions: what would happen to the biosphere if that nitrogen all piled up rather than being recycled by microbes into the atmosphere? How much can the microbes handle? Are we changing their environment in ways that might lead them to recycle too much? Or too little?

And Smil has opened only one of many doors. What does agriculture do to the land itself? To the living systems that support it? How do energy and agriculture interact? What does the future of one mean for the future of the other?

There is remarkably little of this cross-disciplinary thinking. I find it remarkable that all the fierce debates about Thomas Malthus have revolved about the secondary question: Can food production stay ahead of population growth? Almost nobody (including Malthus himself) has asked, how might the effort to keep expanding food yields itself affect the natural systems that support us?

And that brings me to David and Marcia Pimentel. They have regularly suggested the unthinkable: that the solution to a given problem may lie outside the boundaries of that particular discipline. More systematically than any other scientific writers I know, they have regularly crossed scientific boundaries to explore the interactions of modern agriculture with other issues. For example: the role of pesticides in developing more virulent pests; the interaction between the tightening supplies of fossil fuels and future agricultural output; water shortages and the future of food production; the effects of modern agriculture on soil productivity; the ramifications of chemical-intensive agriculture; dietary habits and the ability of the world to support human numbers; and – above all – the size population that world and U.S. agriculture can sustainably support without damage to other systems.

The Pimentels and a few like them have ventured into inter-disciplinary studies at the level of research itself, and therein lies their importance. They are leading the way in bringing the boundaries of research into better correspondence with the nature of reality. I hope they will be followed in the twenty-first century by rising numbers of interdisciplinary researchers who may teach us the true ramifications of human activities. That in turn could be the beginning of a willingness to deal with the imbalances we have generated – starting with the extraordinary growth of human numbers and activity in the past two generations.

Enough. The reader is interested in hearing the Pimentels' viewpoint, not mine. I hope you will find the following excerpts as stimulating as I did.

LINDSEY GRANT

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Pests, Pesticides, and Growing Populations

An interview with David Pimentel

by John F. Rohe

As an important part of this issue's feature section, *The Social Contract* asked author and environmental activist John Rohe to interview David Pimentel. The interview was conducted on Memorial Day, 2002.

JOHN ROHE: *Thank you, Dr. Pimentel, for taking the time for this interview for* The Social Contract.

DAVID PIMENTEL: My pleasure.

JR: Can I ask when you were born?

DP: May 24, 1925. I just had a birthday.

JR: Happy Birthday. Where were you born?

DP: Fresno, California. I spent my first six years there on a farm.

JR: And from there?

DP: From there we moved to Massachusetts, to another small farm in Middleboro.

JR: When you turned eighteen we were midway through World War II.

DP: I was a teenager. I volunteered. Yes, the war was on, and we all had a patriotic spirit. Everybody was going in. So, I decided it was a good time to go. I joined the Air Force as soon as I turned eighteen, and trained to be a pilot. I was relatively young for the Second World War. The military gave this farm boy a wonderful experience, meeting a wide variety of people.

JR: When did you start college?

DP: In 1945 when I was about 20. I was only in the Air Force for two years. When I got out, I immediately went to the University of Massachusetts and majored in animal science, and subsequently switched to entomology during my last year in college.

JR: You are still dealing with animals.

DP: Still animals, but insects in this case.

JR: Were there any other influential events in your early life that influenced your love of animals.

DP: Yes, growing up on a farm there were many types of animals, like goats, geese, and chickens. Also there were books. I remember in particular the Thornton Burgess books. He had a book on Blacky, the crow, one on Peter Rabbit, and he really did a super job of introducing these animals and their behavior and ecology to young people in grammar school. He must have had twelve or fifteen books. Each of them dealt with a particular animal, but then he related each animal to all the other animals that existed in the ecosystem.

JR: The web of life?

DP: Yes. Burgess focused on one at a time, but related each to the other animals in that ecosystem.

JR: Well, I notice that along the way you spoke of the interconnectedness. Not just seeing one animal on its own, but the relationship between it and the surroundings. Was that a novel idea at that time?

DP: This interrelationship was a novel idea for most biologists.

JR: Well, it's obviously difficult for many of the readers of The Social Contract *who might not have been around in 1935, when you would have been reading the Burgess books, to know what was going on at that time. Darwin had released his* Origin of Species *in 1859.*

DP: Darwin, in a way, was a systematist, or a taxonomist, and collector. And what he did was carry biology a major step further. That is, he asked: what did all this collection of organisms that he was observing mean? That's when he put together his theory on natural selection, the relatedness of animals and plants. Linneas, in Sweden, was the first one to introduce the taxonomic system of binomial names in

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John F. Rohe *is an attorney in Petoskey, Michigan. His most recent book is entitled* Mary Lou & John Tanton: A Journey into American Conservation, *FAIR Horizon Press, 2002.*

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the 1700s.

JR: Well, it's interesting to me that the interrelated relationship of animals in your readings might have been one of the moving forces, one of the motivational criteria, that caused you to follow in this path.

DP: During the time of my graduate study at Cornell University (1948 to 1951) the U.S. was having a serious pollution problem with pesticides. In part, that was also a stimulus to me to become more concerned about the integrity of our environment and all of these interrelationships.

"When [Rachel Carson's] book came out in 1962 it caused quite a controversy, especially among the pro-pesticide people."

JR: We're a full ten years before Rachel Carson released her monumental work. What kind of information was out there?

DP: We were aware of this problem, but what she did in her book was to take all this information and to put it into perspective. Of course she was a beautiful writer. She put the information at a level so the general public could understand these pollution problems.

JR: You say that the information that she was banking on was already out there?

DP: Yes, I and others had already written some papers focusing on these problems.

JR: Can you tell me the approximate year and topic of those papers?

DP: I published some of my papers in 1949-1950, almost ten years before her book appeared.

JR: Do you remember the topics of the early articles?

DP: Yes. Some of them dealt with the pesticide resistance problem. Some of them dealt with ways and means of reducing the pesticide pollution problem. And some of them dealt with the impact of pesticides on beneficial organisms. One was on the ecology of insects.

JR: Did you have occasion to meet Rachel Carson in those early days?

DP: No, I never met her. When her book came out in 1962, it caused quite a controversy, especially among the pro-pesticide people. Incidentally, I am now president of the Rachel Carson Council.

JR: Is there a Rachel Carson Council website where The Social Contract *readers could go?*

DP: There is a website for the Council, it is <www.hometown.aol.com/rccouncil/ourpage/index.htm>.

JR: Now we've got a little gap here from 1951 to 1955.

DP: The Korean conflict started in 1950. The Air Force wanted me to fly jets in Korea. I was just graduating with my Ph.D. and I wasn't enthused about flying jets in Korea. I preferred to use my scientific training instead of my pilot training. I approached the U.S. Public Health Service, which is a commission corps, and I was able to have my commission transferred from the Air Force into the U.S. Public Health Service. I was sent to Puerto Rico to do research on the Indian mongoose that had been introduced and had become a serious problem – particularly as a vector and reservoir of rabies. Another study was the ecology and control of schistosomiasis. This is a disease of humans caused by a small helminth in Puerto Rico.

JR: Once infected, it was pretty hopeless to try to reclaim a person's life. OK, so now, in 1955, you have completed your government service and you're starting the ecology curriculum at Cornell University along with adding further training to your background.

DP: I spent two winter quarters 1954-1955 at the University of Chicago as a postdoctoral investigator working with Professors T. Park and A. Emerson, two of the world's leading ecologists. Then, in 1961, I was awarded an OEED Fellowship at Oxford University and studied under Charles Elton and Dennis Chitty – both outstanding ecologists.

JR: Did you craft that curriculum already in the early days?

DP: In 1957, I started the General Ecology course.

JR: And, how long did you teach that?

DP: For about seven or eight years.

JR: Now we're at Rachel Carson – at Silent Spring.

DP: Then I became chairman of the department of entomology and limnology, as it was called at that time, which is when I hired a faculty person to take over the course.

JR: Did you remain with the department of entomology then?

DP: I was with the department until 1969 when I resigned as chair, took a sabbatical, and went on the staff at the White House for a year. At that time, I also

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wrote a book on the ecological impacts of pesticides.

JR: Who was then in the White House?

DP: President Nixon. As you know, he started the Environmental Protection Agency.

JR: You were just two years shy of the Rockefeller Report of 1972 on the U.S. population. I have a suspicion that discussions of that were already in the making while you were at the White House.

DP: Yes, that too.

JR: Are there any other things we would want to mention of the 1960s, before we move beyond 1970?

"I was on several National Academy of Sciences committees. We were looking at what were going to be the primary research problems in agriculture twenty-five years into the future."

DP: They were trying to ban DDT based on Rachel Carson's book, but it took another ten years after her book to ban DDT.

JR: I presume you were pretty active in those battles.

DP: Yes I was, giving testimony and so forth.

JR: How would you characterize the forces that were lined up against you there?

DP: Industry in particular fought very strongly to prevent the banning of DDT and chlorinated insecticides. So it was a tough battle.

JR: Now, probably somewhere after 1970, you started to get more involved in looking at global links – people versus resources – the big picture – freight train momentum.

DP: That's right. I was on several National Academy of Sciences committees. We were looking at what were going to be the primary research problems in agriculture twenty-five years into the future. I was also part of another investigation that focused on population and food production.

JR: And what years were these?

DP: Well, the one on looking to the future of agriculture was late 1968. But the one on population was about 1970-1972. There were some others that related to this issue. At the same time I became Chair of the Board on Environmental Sciences in the National Academy of Sciences.

JR: I assume you were back at Cornell.

DP: Yes, but I did this work for Washington from Cornell University.

JR: I'm seeing a trend. You started with animals, pesticides affecting small animals. Then you are in a transitional phase. In the early 1970s, through the NAS years, you are moving into population, global issues, the big picture, the bird's eye view, more of a global strategy, more than a strategy on somebody's cornfield.

DP: The initial experience in the NAS prompted me to start another course that had never been taught at Cornell. It was called Environmental Policy. I started that in 1970. I took a small group of graduate students and seniors and we focused on a chosen important environmental problem. After a year's investigation, we published our report in *Science* or *Bioscience*. The very first study that we undertook with this new course focused on the energy used in agriculture. The paper was published in 1973 in *Science*, right at the peak of the energy crisis. We couldn't have timed it better.

JR: Timing is everything.

DP: It is. No question about it.

JR: Clearly, today, from my out-of-the-way vantage in a remote part of the U.S., I see your name with great regularity, and you are unquestionably one of the leaders in thinking about the major issue of our day: people versus resources.

DP: We're trying to save the world, and we're not doing a very good job at it.

JR: What do some of your other papers address?

DP: We've done studies on environmental and public health impact of pesticides attempting to get an economic as well as an environmental dimension of this problem. We've done more on energy. For example, what could we do to move into a renewable energy system? We have also looked at the environmental impact of energy uses, and what we could do about these problems. We have been on the soil erosion problem, and water problems in the U.S. and the world.

JR: Well, I can't help but reflect on John Muir's comment that the more he looked out in nature, the more everything looked like it's hooked together.

DP: It's sort of like those Burgess books I told you

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about. When I focus on soil, it relates to water, that relates to the population, that relates to energy use, and so forth. So even though we focused on any one of these resources, each time we related it back to the total system.

JR: O.K. so where are we today?

DP: Today, we have become interested in the issue of invasive species. (Incidentally the report the students and I wrote was published in the year 2000 in *Bioscience.*)

JR: Any papers this year?

DP: The paper we have this year is on energy conservation and technology.

JR: And, when you say students, are these undergraduates?

DP: Graduate students, seniors.

JR: Do you have any expectations of where that might be published?

DP: We are tentatively planning to send it to the new journal called *Environmental Development and Sustainability.*

JR: We have read your works and we capture a glimpse of ourselves barreling onward like a freight train building momentum. There's a cliff down there and a few people are trying to apply the brakes. Where do you see this population freight train going?

DP: It is very disturbing when you ask that particular question because there is an enormous momentum built into world population numbers. This is illustrated by the fact that if the world population agreed to just two children per couple, which is zero population growth, and you asked how long would it take for the world's population to stabilize – population would continue to increase for about 70 years before stabilizing. World population would increase from approximately 6 billion today to approximately 12 billion before the population stabilized. As you know, China was trying to implement a policy of one child per family. Had they been 100 percent effective with one child per couple, they would have added a population slightly less than the U.S. population in 25 years – even with one child per couple. But again, it's the young age structure that is resulting in their rapid population increase.

JR: People have to move beyond their childbearing years before population actually starts to level out.

DP: Yes, and we have other problems. The World Health Organization reports we have more than 3 billion people who are malnourished – half of the world population. This malnutrition makes people more susceptible to AIDS, TB, malaria, and other diseases. So we have diseases on an increase worldwide due to malnourishment, we have per capita food production declining. Per capita food production has been declining for the last 18 years despite biotechnology and all the other agricultural technologies we have available. We know we are losing valuable crop land due to soil erosion. We know that water, which is essential for agricultural production, is decreasing per capita. Then, we know that energy is crucial for food production. The U.S. has already pumped out more than 80 percent of our oil underground. We are now importing 61 percent and it is projected to go to 90 percent imports in the next 15 years.

JR: Is this going to turn around? Do you see any forces out there that would enable it to turn around? Do we just give up, go home, get drunk, throw a party, and be done with it?

DP: Earlier, in our previous papers, we used to say that if humans do not control their numbers, nature is going to do it for us. And now, we actually have clear evidence that nature is starting to do it for us. More than one-half the world population is malnourished – malaria, TB, AIDS, and other diseases are increasing. Nature is starting to control our numbers.

JR: Have you conceived any formula for what we would do if we are to make a move to take control and wrest this away from nature, and try to make some of the decisions for ourselves? What do you see as some of the moving forces to make this transition?

DP: I would like to see us do something about the population question. In the U.S., for example, I believe we need a moratorium on immigration until we decide what standard of living, what resources are available – fresh water, crop land, and land needed for renewable energy. I believe we ought to look at all these resources and where the U.S. population wants to go in the future.

JR: Do you have a sense for what the optimum U.S. population would be?

DP: Yes, we suggested about 200 million. Of course, the U.S. now has nearly 300 million.

JR: Yes, and how about globally?

DP: Globally, we suggested 2 billion, and of course, the world population is already at 6.2 billion.

JR: And, you say if we now go to ZPG, it will be at 12 billion.

DP: Yes, that's right, even with two children per couple, it would take 70 years for the world population

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to stabilize and by then our population would reach 12 billion.

JR: So when we see studies that project a plateauing out of 9 to 12 billion, there's a strong assumption there that the fertility rate would be at subreplacement fertility level.

DP: It has to be. For example, the UN says that by 2050 we would have 9 billion people. But, they never stated what would cause the die off to reach that 9 billion. Would they advocate zero children, or something like that? They never say what would achieve this 9 billion.

JR: If you were to write a succinct message for the world, here, today, a succinct message, what would you say?

DP: Two things. Number one, we ought to protect and conserve the vital resources that provide us with our food, such as crop land and fresh water, energy, and biological resources. Second, we have to stop population growth.

JR: There are a number of places, like Italy, that have been at well below replacement level fertility for decades.

DP: Yes, but they have a young age distribution. So they really haven't stopped increasing their population. That is true for most of Europe. Italy and the rest of Europe are severely overpopulated.

JR: Well, fertility has a bearing on the dependency ratio between workers and retirees.

DP: Yes, but they are overpopulated. They have to import resources primarily from developing countries which don't have adequate resources either. And so, if they could start not only reducing their reproductive rate, but also reducing their population, it would be of great benefit to them and to the world.

JR: Now when you say we should bring down our fertility, would you send that same message to the seventy nations that are already below replacement level fertility, or does your message apply to others?

DP: They not only have to achieve a low fertility, but they have to slowly change their age structure, because it's age structure that is the important dimension to population growth. China, Mexico, and even Europe have young age distributions.

JR: And what do you tell a nation that has a different age structure, where you have the elderly and few young people?

DP: As I also said in our paper, the social and economic problems of an aging population are still significantly less than the social and economic problems of a rapidly growing population.

JR: Does your message on how many children to have then shift from one country to the next, depending on fertility, age distribution, and those factors?

DP: Yes, each nation must take into account the fertility related to the age structure of their population. And, of course, they have to take into account what resources are available and what standard of living the nation desires.

JR: You've been very generous with your time, Doctor.

DP: Well, I enjoyed talking to you. ■

David Pimentel

Education

1945-1948	Univ. of Massachusetts, Amherst, B.S.
1948-1951	Cornell Univ., Ithaca, NY, Ph.D.
1961	Oxford Univ., England, (OEEC Fellow)
1961	Massachusetts Institute of Technology Cambridge, NSF Computer Scholar

Positions

1951-1955	Chief, Tropical Research Laboratory, U.S. Public Health Service, San Juan, Puerto Rico
1955-1960	Assistant Professor of Insect Ecology, Department of Entomology, Cornell University
1960-1963	Associate Professor of Insect Ecology
1963-1969	Professor and Head of Department, Entomology and Limnology, Cornell University
1969-	Professor of Insect Ecology and Agricultural Sciences, Department of Entomology and Section of Ecology and Systematics, Cornell

Dr. Pimentel's honors include many invitations to give lectures and keynote addresses throughout the world at prestigious conferences related to agricultural ecology, pesticides, genetics, and population growth.

He has chaired various panels and commissions in relation to pesticides, pollution, energy, ecological economics, genetics, and food supply. He serves as a member of the National Board of Directors of Carrying Capacity Network, of the National Audubon Society, and of the American Institute of Biological Sciences. He is a member of the International Advisory Committee, 2020 Vision for Food Agriculture, and the Environment of the International Food Policy Research Institute.

Dr. Pimentel has contributed hundreds of articles on these topics to various books and scientific journals. He has served as editor for such books as *The Pesticide Question: Environment, Economics, and Conservation; Techniques for Reducing Pesticide Use: Environmental and Economic Benefits; Some Aspects of Integrated Pest Management.*

David and Marcia Pimentel authored *Food, Energy, and Society*, revised in 1996 and published by the University Press of Colorado.

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Energy and Power

by David Pimentel and Marcia Pimentel

Energy is defined as the capacity to do work. Although energy is found in many forms (Table 2.1), all forms have the capacity to do work. Light energy coming from the sun is the most important and universal type of energy, supporting all life on Earth. Plants have the capacity to capture, or "fix," light energy and convert it into chemical energy, which is used by the plants themselves and the animals that feed on them. Many human activities, most prominently agriculture and forestry, rely on solar energy. Solar energy is also fundamental to wind power, hydroelectric power, and other types of energy systems.

Radio, radar, micro, and television waves use electrical energy. The lifting or moving of objects by man or machine is a form of mechanical energy. Another form of energy – heat generated by the burning of wood, coal, oil, or gas – is used for cooking and to drive engines. Magnetic energy, which is produced from the interaction of positively and negatively charged matter, can be used to do work. Sound waves, another form of energy, are used in communications and other activities. A more recently discovered form of energy is nuclear energy, which is released from the bound atomic particles in, for instance, uranium. Humans have employed nuclear energy not only to create devastating bombs but also to produce electricity.

Laws of Thermodynamics

The use or flow of energy is governed by the two laws of thermodynamics. *The first law of thermodynamics states that energy may be transformed from one type into another* (Table 2.1) *but can never be created or destroyed.* For example, light energy can be transformed into heat energy or into plant-food energy (chemical energy). In the process of this transformation, no energy is lost or destroyed; only its form is changed.

The second law of thermodynamics states that no transformation of energy will occur unless energy is degraded from a concentrated form to a more dispersed form. In the real world all energy transformations take place in open systems, because processes necessarily interact with their environment over finite time periods. *Thus, according to the second law, in the real world no transformation is 100 percent efficient.*

The second law states the existence of a spontaneous "direction" for energy transformations. For example, if a hot object is placed next to a cool object, heat will flow from the hot object to the cool one but never in the reverse direction. Because no transformation is 100 percent efficient, the temperature of the cool object will rise, but not enough to account for all the energy that is transferred from the hot object. In the transfer some energy is dispersed into the environment. Consider the example of a cup of boiling water mixed with a cup of cold water. The temperature of the resulting mixture is slightly lower than would be calculated by measuring the energy lost by the boiling water. The cold water is much

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Marcia Pimentel *is a Senior Lecturer (retired), Division of Nutritional Sciences in the College of Human Ecology at Cornell. She has authored a book and several papers dealing with nutrition and human populations.*

This essay is a chapter from their book, Food, Energy, and Society, *Revised edition, University Press of Colorado, 1996.*

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Table 2.1 Some examples of energy conversion and energy-converting devices

To	From Mechanical	From Thermal	From Acoustical	From Chemical	From Electrical	From Light
Mechanical	Oar Sail Jack Bicycle	Steam engine	Barograph Ear	Muscle contraction Bomb Jet engine	Electric motor Piezo-electric crystal	Photoelectric door opener
Thermal	Friction Brake Heat Pump	Radiator	Sound absorber	Food Fuel	Resistor Spark plug	Solar cooker Greenhouse effect
Acoustical	Bell Violin Wind-up phonograph	Flame tube	Megaphone	Explosion	Telephone receiver Loudspeaker Thunder	
Chemical	Impact detonation of nitroglycerine	Endothermic chemical reactions		Growth and metabolism	Electrolysis	Photosynthesis Photochemical reactions
Electrical	Dynamo Piezo-electric crystal	Thermopile	Induction microphone	Battery Fuel cell	Transformer Magnetism	Solar cell
Light	Friction (sparks)	Thermoluminescence		Bioluminescence	Light bulb	Fluorescence

Source: After Steinhart and Steinhart, 1974a

warmer than it was initially, but because some of the heat energy is lost to the environment, it will not be as hot as the average of the two initial temperatures.

All biological systems, including crops, follow the second law of thermodynamics when solar energy (a high-energy form) is converted into chemical energy. Plants utilize this chemical energy in the process of building their own tissue. Some of the energy being changed from light to chemical energy is lost as heat that dissipates into the surrounding environment.

Measures of Energy and Power

The basic unit of energy, following the International System (SI) of units, is the joule (J), but many other units of energy are used, such as the calorie, Btu (British thermal unit), quad, kWh (kilowatt hour), TOE (metric tons of oil equivalent), and TCE (metric tons of coal equivalent). Both the calorie and Btu, which are probably the most frequently used units, are based on measurements of heat energy. A calorie, or gram-calorie, is the amount of heat that is needed to raise 1 g of water 1°C at 15°C. The Btu is the amount of heat needed to raise 1 pound of water 1°F. Note that heat measurements are related not to the direct ability to do work but to the capacity to raise the temperature of matter or to change the state (solid, liquid, gas) of matter.

Conversion factors for energy units are listed in Table 2.2. Note that the kilocalorie (kcal), or kilogram-calorie, equals 1000 calories, or gram-calories. The large Calorie, used in the field of nutrition, equals 1 kcal, or 1000 small calories.

Measurements of energy do not take into account the time required for the conversion process. Work, however, requires the expenditure or use of energy at a certain rate. The term "power" expresses the rate at which work is done and/or energy is expended. The basic unit of power is the Watt (W), which equals 1 joule/second, 14.3 kcal/minute, or 3.41 Btu/hour. Another unit of power commonly used is the horsepower (HP); 1 HP equals 746 W or 2542 Btu/hour.

When the power level, or rate at which work is done, is multiplied by the time the work requires, we obtain the total flow of energy. For instance, the maximum work capacity or power level that a horse can sustain for a

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Table 2.2 Energy conversion factors

Unit	Equivalents
1 kilojoule (kj)	1000 joules (J)
1 kilocalories (kcal)	1000 calories (cal); 4.184 kJ; 4184 J
1 British thermal unit (Btu)	0.252 kcal; 1.054 kJ; 1054 J
1 quad	1015 Btu;0.252 x 1015 kcal;1.054 x 1018 J
1 kilowatt hour (kWh)	3413 Btu; 860 kcal; 3.6 MJ
1 horsepower hour (Hph)	0.746 kWh; 2546 Btu; 642 kcal; 2.69 MJ
1 ton of coal equivalent (TCE)	7 x 106 kcal; 29.31 GJ
1 ton of oil equivalewnt (TOE)	107 kcal; 41.87 GJ

Note: Kilo (k) = 10^3; mega (M) = 10^6; giga (G) = 10^9; tera (T) = 10^{12}; peta (P) = 10^{15}

ten-hour working day is 1 HP. The power level of a person is about one-tenth of 1 HP; therefore a person working a ten-hour day produces an energy equivalent of only 1 Hph (horsepower hour), 2.7 MJ (megajoules), or 0.75 kWh. Put another way, one horse can accomplish the same amount of work as ten people in one hour. Horsepower and oxpower were some of the first substitutes for human power and contributed to improving the quality of human life. Certainly people tilling the soil in early agriculture were more productive when they used oxen and horses.

The tremendous effect of technological development on human activities can be appreciated by comparing manpower to the mechanical power of a tractor fueled with gasoline. One gallon (3.79 liters) of gasoline contains about 38,000 kcal of potential energy. When this gallon of gasoline fuels a mechanical engine, which is about 20 percent efficient in converting heat energy into mechanical energy, a equivalent of 8.8 kWh of work can be achieved. Hence, a single gallon of gasoline produces more power than a horse working at maximum capacity for 10 hours (7.5 kWh). Further, one gallon of gasoline produces the equivalent of almost three weeks of human work at a rate of 0.1 HP, or 0.075 kW, for 40 hours a week.

Biological Solar Energy Conversion in Agriculture

The survival of humans in their ecosystem depends upon the efficiency of green plants as energy converters. The plants convert sunlight into food energy for themselves and other organisms. The total foundation of life rests on plants' unique capacity to change radiated solar energy into stored chemical energy that is biologically useful for humans and other animals.

The amount of solar energy reaching 1 hectare (ha) each day in the temperate region ranges from 15 to 40 million kcal. Over a year's time the total solar energy received per ha ranges from 1.1 to 1.8 x 10^{10} kcal, with 1.4 x 10^{10} kcal as a reliable average. This is equivalent to the energy potential of nearly 452,000 gallons (1.7 million liters) of gasoline per year per ha. This sounds like a large quantity of energy, and indeed it is when considered as a unit. But each square millimeter (mm) receives only 0.0038 kcal per day, only enough to raise the temperature of 3.8 milliliters (ml) of water 1°C.

Green plants are able to capture only a small percentage (0.1 percent) of the sunlight reaching the earth (Whittaker and Likens, 1975; ERAB, 1981). Annually, the total light energy fixed by green plants in ecosystems is estimated to be about 400 x 10^{15} kcal, divided equally between terrestrial and ocean ecosystems (Pimentel et al., 1978). Note that although terrestrial systems cover only about a third of the earth, the plants in these systems fix about half of the total light energy captured.

When only the temperate zone is considered, estimates are that only 0.07 percent of the 1.4 x 10^{10} kcal of sunlight per ha is fixed in terrestrial ecosystems (Reifsnyder and Lull, 1965). Thus, the net energy fixed by plants in the temperate zone averages about 10 million kcal/ha per year. Expressed as dry weight of plant material, this amounts to an average yield of 2400 kg/ha per year, ranging from near zero in some rock and desert areas to 10,000 kg/ha in some swamps and marshes (Whittaker and Likens, 1975).

In agricultural ecosystems, an estimated 15 million kcal of solar energy (net production) is fixed per ha per crop season. Even so, this amounts to only about 0.1 percent of the total solar energy reaching each ha during the year and equals about 3500 kg/ha of

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dry biomass. The amount of biomass varies with the crop and ranges from 200 kg/ha for low production crops under arid conditions to 15,000 kg/ha for corn and sugarcane. An average agricultural ecosystem produces an annual biomass per ha slightly greater than that in natural ecosystems. This is not surprising, as crop plants are grown on the most fertile soils and are usually provided with ample moisture and essential nutrients. Under optimal conditions, during sunny days in midsummer and when the plants are nearing maturity, crops such as corn and sugarcane capture as much as 5 percent of the sunlight energy reaching them. However, the harvested plant material is only about 0.1 percent because over much of the year, including winter, there is no plant growth.

A significant quantity of captured energy is, of course, utilized by the plant itself. For example, a soybean plant uses about 25 percent of the energy it collects for its own respiration and maintenance. About 5 percent of the energy is diverted to provide food for the nitrogen-fixing bacteria that are symbionts with the soybean plant. Another 10 percent is lost to insect pests and pathogens that feed on the plant. Thus, the net yield in beans plus vegetation is about 60 percent of the energy collected by the plant.

Most plants divert significant proportions – from 5 to 50 percent – of the energy they collect into their fruits and seeds, illustrating the high priority plants give to reproduction (Harper, 1977).

Humans have used breeding techniques to reallocate energy in plants and improve crop yields. For example, one of the factors contributing to the increased yields in new breeds of corn has been the change in energy allocation within the plant. In particular, the new breeds produce smaller tassels and less pollen, and the energy saved is reallocated to the production of corn grain. With corn plants, growing as densely as they do under normal cropping conditions, the smaller tassel and less abundant pollen are satisfactory for the production of corn seed.

Renewable Biological Energy Versus Fossil Fuel Energy

By the sixteenth century, England and France were running out of firewood, their most important source of renewable biomass (Nef, 1977). Humans used wood to cook and prepare foods and to heat the homes of the expanding population. They also used it to produce charcoal for the developing metal industry and to provide lumber for the growing shipbuilding and construction industries. Because of wood shortages, London and Paris were forced to turn to soft coal as a substitute fuel (Cook, 1976). Because soft coal is noxious when burned, wood remained the preferred fuel, and those who could afford its high price continued to burn wood. During the eighteenth century, coal was used primarily for heating, its use as a source of energy to replace human and horse power did not occur until the nineteenth century.

Coal was used extensively, however, to fuel pumps in mining operations. As mines were dug deeper, water began seeping into the mines and caused serious flooding problems. The mine operators used windmills, hand pumps, and windlasses to remove water, but with poor results. Then, in 1698, Thomas Savery invented the first steam-powered pump to remove water from the mines. This pump, however, proved dangerous to operate and was never fully adopted. About ten years later, Thomas Newcomen designed a much-improved steam-powered pump that was extensively employed in the mines. Thereafter coal could be mined more efficiently, and a good supply was ready to replace the declining supply of firewood. It was not until nearly 1000 years later that James Watt designed a truly efficient steam engine and pump. When the Watt pump was finally operational, it rapidly replaced the Newcomen steam pump.

The Watt steam engine and the internal combustion engine, developed in 1876, brought dramatic changes in energy consumption. These new fossil fuel-powered engines quickly replaced the less efficient wood-powered steam engines, the horse, and even human power. Production of goods increased, expenditure of energy increased, and each subsequent decade witnessed a further increase in the use of non-renewable fuel resources.

In the United States from 1700

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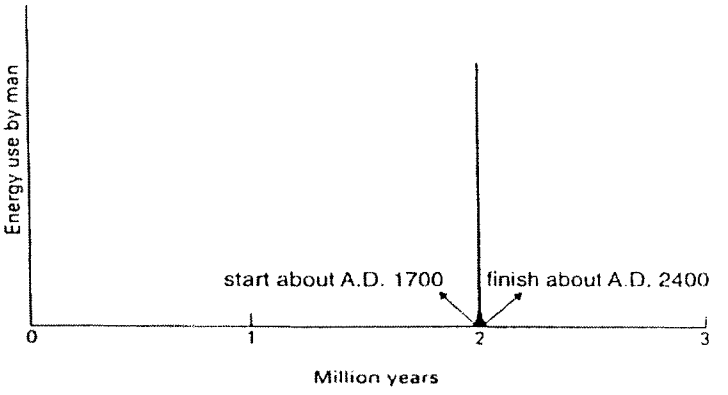
to 1800, wood was the primary source of fuel. As late as 1850, more than 91 percent of the energy used in the United States came from wood burning (EOP, 1977). The supply of wood was sufficient in the eighteenth and earl nineteenth centuries, for two reasons. Not only was the population about 23 million people, or less than 9 percent the present level, but these early settlers consumed only about one-fifth the amount of energy consumed today. Furthermore, American forests had been harvested for only a relatively short period of time compared to European forests. Even so, as early as 1850 firewood was in short supply in the Northeast, especially for larger cities such as New York and Boston, because of the rapid clearing of forest land for agricultural production and the relatively heavy demand for firewood. The problem was worsened by the difficulty and high costs of transporting the bulky and heavy wood over increasingly long distances to the cities.

Obviously, forests cannot meet the high energy needs of today's large U.S. population. At present, fossil fuels account for 92.5 percent of the total fuel consumption in the United States. Of this, oil represents 40 percent, natural gas 28 percent, coal 26 percent, and nuclear fuels, 6 percent. Firewood accounts for only 4 percent and hydroelectric energy the remaining 3.5 percent of the total fuel. Fossil fuel consumption today is the highest it has ever been. Annual consumption for the world stands at about 319 quads (80.4 x 10^{15} kcal) and is increasing every year (IEA, 1991). The United States alone consumes 25 percent of all the fossil energy used in the world annually, amounting to 79 quads (19.9 x 10^{15} kcal) (IEA, 1991).



2.1 The epoch of the use of fossil fuels in the history of man on earth.

The epoch of fossil fuel use has been but a short interval in the more than one million years of human existence on earth (Figure 2.1). The era of reliance on fossil fuels will be but a small "blip" in history – about 400 years, or at most 0.1 percent of the time humans have been on earth. Because fossil fuels are nonrenewable resources, they eventually will be exhausted. Oil and gas supplies will be the first fossil fuels to run our. According to the best estimates, 30 to 50 years of these resources remain (Matare, 1989; Worldwatch Institute, 1992a). The United States has only 10 to 20 years of oil reserves remaining, based on current use rates (DOE, 1991a). U.S. oil imports now amount to 54 percent of the country's total use, and this share is expected to increase to about 70 percent by the turn of the century. Most of the European countries, Japan, and several other countries in the world import *all* of their oil, which places a strain on their economies.

The world's coal reserves are greater than those of oil and gas because the latter fuels have been more extensively used than coal. There is still an estimated 100-year supply of coal in the world (Hubbert, 1972; Matare, 1989; Worldwatch, 1992a). However, continued heavy use of fossil fuels may cause grave problems relating to global climate change (Schneider, 1989). In addition, the burning of fossil fuels results in major air pollution problems, and coal mining, especially strip mining, damages the environment, destroying vast areas of land valued for food and forest production and wildlife. On average, strip mining is safer for miners, is more economical, and requires less energy than deep underground mining, and it is 80 to 90 percent effective in recovering coal, whereas deep

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mining is only 50 percent effective. In deep mining small coal seams cannot be economically mined because of the danger of cave-ins.

Coal production requires less energy than oil drilling both in extraction and transportation. About 20 percent of the potential energy in oil is expended to extract and refine it (Cervinka, 1980), resulting in a yield of about 80 percent at point of use. By comparison, coal has a yield of about 92 percent (Cook, 1976). This means that about 108 kg of coal must be mined to produce the equivalent of 100 kg of coal energy, compared with 120 kg of oil pumped for 100kg of oil energy.

Coal reserves are scattered throughout the world. Western Europe has about 5 percent of the total, the United States about 20 percent. Russia is extremely well endowed, with nearly 56 percent of the estimated coal reserves.

Adjusting from oil and gas to coal will require many changes in lifestyle and industrial production methods. The world is indeed fortunate to have coal reserves as a backup energy resource until, renewable energy technologies are developed to supply a portion of the world's energy needs. ■

Land, Energy, & Water

The constraints governing ideal U.S. population size

by David Pimentel and Marcia Pimentel

For most of this century, leading scientists, public officials, and various organizations have been calling attention to the rapidly growing human population and the deteriorating environment throughout the world (Ehrlich and Holdren, 1971; Meadows, et al., 1972; CEQ, 1980; Keyfitz, 1984; Demeny, 1986; Hardin, 1986). Based on these assessments, genuine concerns about maintaining prosperity and quality of human life in the future have been expressed.

In the United States, humankind is already managing and using more than half of all the solar energy captured by photosynthesis. Yet even this is insufficient to our needs, and we are actually using nearly three times that much energy, or about 40 percent more energy than is captured by all plants in the United States. This rate is made possible only because we are temporarily drawing upon stored fossil energy. We are approaching the end of the petroleum era, and other fossil fuels are not inexhaustible. Moreover, the very use of these fossil fuels, plus erosion and other misuse of our natural resources, are reducing the carrying capacity of our ecosystem.

These are not sustainable conditions, and our natural resources cannot be expected indefinitely to maintain a population as large as the present one, without a remarkable decline in our living standards.

Thus far, our society appears unable to deal successfully with problems of the environment, resources, and population. It has a poor record of effectively managing and protecting essential environment and natural resources from over-exploitation caused by ignorance, mismanagement, and the impact of growing human numbers. History suggests that these escalating problems exist

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because the United States has not developed a cohesive policy that recognizes a specific standard of living for its citizens, while clearly acknowledging that the attainment of such a standard depends on the interaction of environment, resources, as well as population density.

When decisions concerning the environment and natural resources are made in the United States, and indeed throughout the world, they are *ad hoc* in nature and are designed to protect or promote a particular or immediate aspect of human well-being and/or the environment. All too often solutions are sought only after a problem reaches a crisis status. As Benjamin Franklin wrote long ago in *Poor Richard's Almanac*, "it is not until the well runs dry, we know the worth of water." Based on experience, it will not be until the pressure of human population on the environment and resources becomes intolerable that some corrective action will be taken by individuals and governments. Then it may be too late to avert hunger and poverty.

In this essay, we examine the degradation of the environment, the consumption of non-renewable resources, population growth, and the possible decline in U.S. prosperity. We also suggest that *dramatically reduced U.S. population densities would ensure individual prosperity and quality environment for future generations.* The goal is to have sufficient information and understanding of the problems so that sound policies are possible.

Table 1. Foods and feed grains consumed per capita (kilogram) per year in the United States and China (Pimentel et al., 1989).

Food/feed	USA[a]	China
Food grain	69	269[b]
Vegetables	112	204[c]
Fruit	63	11[d]
Meat and fish	103	25[d]
Dairy products	265	3[d]
Eggs	15	6[d]
Fats and oils	28	6[d]
Sugar	66	6[d]
TOTAL	721	530
Feed grains	801	64[b]
GRAND TOTAL	1,522	594
Kilocalories/person/day	3,500	2,484[e]

[a]USDA, 1985.

[b]Total grain production per capita in 1985 was 364 kg (CDAAHF, 1986). It is estimated on the basis of some unpublished data that 8.5% of the total grain production was used for seeds and industrial materials, 17.5% for feed and 74% for food (Wen, personal communication, 1987).

[c]Estimated on the basis of total vegetable planting area (Wen, personal communication, 1987).

[d]CDAAHF, 1986.

[e]CAA, 1986.

Resources and Population Density

Innate human behavior indicates a strong will to survive and to achieve some level of prosperity and quality lifestyle. Nations as well as individuals differ in their perception of what they consider a good life for themselves. A comparison of some aspects of life in the United States and China reveals startling extremes and clarifies what Americans can expect in the future if our population continues to grow at its present rate. Both birthrates and immigration function in the population equation.

The present [1990] population of the United States stands at 246.1 million and is growing at a rate of about 1 percent per year (depending on one's estimates of emigration and illegal immigration). If the number of immigrants coming into the United States increases, the rate of U.S. population growth will increase. China has a population of 1.1 billion, and despite the government's policy of one child per couple it is growing at a rate of 1.4 percent or 15 million per year (PRB, 1988).

Statistics suggest that in the United States *we produce and consume about 47 times more goods and services, per capita, than China does* (PRB, 1986). Because achieving and maintaining such consumption levels depends upon the availability resources and the health of the environment that sustains them, our position is very tenuous when projections of future resource availability are considered.

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Currently, approxi-mately 1,500 kg of agricultural products are produced annually to feed each American while the Chinese make do with only 594 kg/capita/yr (Table 1). To produce food for each persons in the United States, a total of 1.9 ha of cropland and pastureland is used, whereas in China only 0.4 ha/person is used (Table 2). The data in these tables confirm that each person in China is fed essentially a vegetarian diet and that they have nearly reached the carrying capacity of their agricultural system.

Since colonial times and especially after 1850, Americans have relied increasingly on energy sources other than human power for their food and forestry production. Relatively cheap and abundant supplies of fossil fuel have been substituted for human energy. Thus, manmade fertilizers and pesticides as well as machinery have helped our farmers and diminished the level of personal energy they must expend to farm. *The Chinese have not been as fortunate and still depend on about 1,200 hours/hectare (h/ha) of manual farm labor, compared with only 10 h/ha in the United States* (Wen and Pimentel, 1984).

Industry, transportation, heating homes, and producing food account for most of the fossil energy consumed in the United States (Pimentel and Hall, 1984, 1989). Most fossil energy in China is used by industry and a lesser amount for food production (Kinzelbach, 1983; Smil, 1984). Per capita use of fossil energy in the United States amounts to about 8,000 liters of oil equivalents per year or 20 times the level in China (Table 2).

Table 2. Resources utilized per capita per year in the United States and China to supply basic needs (Pimentel et al., 1989).

Resources	USA	China
Land		
Cropland (ha)	0.6[a]	0.1[b,c]
Pasture (ha)	1.3[a]	0.3[b]
Forests (ha)	1.3[a]	0.1[b,d]
TOTAL	3.2	0.5
Water (liters x 10^6/yr)	2.5[e]	0.46[c]
Fossil Fuel		
Oil equivalents (liters)	8000[f]	413[g]
Forest Products (tonnes)	14[a]	0.03[c,d]

[a]USDA, 1985.
[b]Wu, 1981.
[c]Smil, 1984.
[d]Vermeer, 1984.
[e]USWRC, 1979.
[f]DOE, 1983.
[g]State Statistical Bureau PROC, 1985.

China with its population of 1.1 billion and a land area similar to ours, already is experiencing diminished per capita supplies of food and other essential resources, plus a deteriorating natural environment as evidenced by the loss of forests and intense soil erosion. The relative affluence presently enjoyed by Americans has been made possible by our abundant supplies of arable land, water, and fossil energy relative to our present population numbers. As our population escalates, our resources inevitably will experience pressures similar to those now experienced by China.

Status of U.S. Environmental Resources

Basic to making decisions about our future is the need to assess both the quality and quantity of land, water, and energy, as well as biological resources we will have at our disposal in coming decades. At our present population level of 246 million we are affluent consumers of all these vital resources, many of which are being depleted, with no hope of renewal after the next 100 years. Although these components function interdependently, they can be manipulated to make up for a partial shortfall in one or more. For example, to bring desert land into production, water can be applied to the land, but only if groundwater or river water is available and if sufficient fossil energy is available to pump the water. This is the current practice in California and many other western states, enabling some of our western agricultural regions to be highly productive.

Land, that vital natural resource, is all too often taken for granted; yet, it is essential for food production and the supply of other basic human needs, like fiber, fuel, and shelter. Currently, Americans use about 0.6 ha/capita of arable land to produce our food. Nearly all the arable land is

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in production (Pimentel and Hall, 1989). Thus. Americans do not have new arable land to open up to take care of a growing population.

At present the soil on U.S. cropland is eroding at rates that average 18/t/ha/yr (Lee, 1984). This is of particular concern because soil reformation is extremely slow; thus, *we are losing topsoil 18 times faster than replacement* (Pimentel et al., 1987). Even now, in what used to be some of our most productive agricultural regions, soil productivity has been reduced 50 percent, and in some areas it has been so severely degraded that it has been abandoned (Follett and Stewart, 1985).

All arable land that is currently in production, and especially marginal land, continues to be highly susceptible to degradation (OTA, 1982; Follett and Stewart, 1985). Although some marginal land has been withdrawn under the new Conservation Reserve Program, all marginal land cannot be removed from production because it is essential to feed Americans. Certainly, efforts should be made to implement soil and water conservation practices on both arable and marginal land (OTA, 1982).

Despite serious soil erosion, U.S. crop yields have been maintained or increased because of the availability of cheap fossil energy for inputs like fertilizers, pesticides, and irrigation (Pimentel et al., 1987). Currently on U.S. farms, *about 3 kcal of fossil energy are being spent to produce just 1 kcal of food.* Our policy of supporting this 3:1 energy ratio has serious implications for the future. One cannot help but wonder how long such intensive agriculture can be maintained on U.S. croplands while our nonrenewable, fossil energy resources are being rapidly depleted.

In addition to use in agricultural production and throughout our entire food system for processing, packaging, and transportation, fossil energy is used to fuel diverse human activities. Overall fossil energy inputs in different economic sectors have increased 20- to 1,000-fold in the past three decades, attesting to our heavy reliance on this energy (Pimentel and Hall, 1984, 1989).

Projections of the availability of these energy resources are not encouraging. In fact, a recent study published this year [1990] by the Department of the Interior reports that, based on the most current oil drilling data, the estimated amount of oil resources has plummeted. This means that instead of having about a 35-year supply of oil we are now limited to a 16-year supply – if use remains at about the current rate. Concurrently, natural gas, an important energy resource, is being rapidly depleted (Mataré, 1989). Reliable estimates indicate that coal reserves are sufficient to last for more than a century (Schilling and Wiegand, 1987; USBC, 1988). Note that nuclear energy is also limited because uranium resources also are facing eventual depletion (Mataré, 1989). A larger population can be expected to put additional stress on usage of all energy resources. Thus, considering population growth and the forecasts about our nonrenewable energy supplies, all efforts need to be focused on conserving current supplies while intensifying research on developing new energy sources.

Along with land and energy supplies, we take water supplies for granted and often forget that all vegetation requires and transpires massive amounts of water. For example, a corn crop that produces about 7,000 kg/ha of grain will take up and transpire about 4.2 millions liter/ha of water during just one growing season (Leyton, 1983). To supply this much water to the crop, not only must 10 million liters (1,000 mm) of rain fall per hectare, but it must be evenly distributed during the year and especially during the growing season.

Of the total water currently used in the United States, 81 percent is used in agriculture while the remainder is needed for industry and for public use (USWRC, 1979). In the future, the rate of U.S. water consumption is projected to rise both because of population growth and because of greater per capita use (USWRC, 1979; CEQ, 1983). The rapid increase in water use already is stressing both our surface and groundwater resources. *Currently, groundwater overdraft is 25 percent higher than its replenishment rate* (USWRC, 1979) with the result that our mammoth groundwater aquifers are being mined at an

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alarming rate. In addition, both surface and groundwater pollution have become a serious problem in the United States, and concern about the future availability of pure water is justified (CEQ, 1980).

Threats to those Resources

Pollution is pervasive throughout our environment and degrades the quality and availability of resources like water, land, air, and biota. For example, when salts are leached from the land during irrigation (up to 18 tons of salts per hectare during the growing season) and deposited in rivers, the effectiveness of the river water for further irrigation is reduced (Pimentel et al., 1982).

Air pollution has a more pervasive impact than water pollution. In the United States, the estimated 21 million metric tons of sulfur dioxide from factories and cars that are released into the atmosphere annually cause serious environmental problems in both our natural and agricultural environments (EPA, 1986). For example, acid rain produced in part from sulfur dioxide is having major environmental impacts on aquatic life in streams and life in U.S. forests.

Further, a wide array of chemical pollutants are released to the air, water, and soil and already are adversely affecting the growth and survival of many of the 400,000 species of natural plants and animals that make up our natural environment. For example, each year about 500 million kg of toxic pesticides are applied to control pests, but all too often kill beneficial species as well. Some of these pesticides leach into groundwater and streams, damaging the valuable plants and animals that inhabit surface waters (Pimentel and Levitan, 1986; Pimentel et al., 1990).

In addition to toxic chemicals, the conversion of forests and other natural habitats to croplands, pastures, roads, and urban spread, in response to expanding population numbers is reducing biological diversity of plants and animals. These *natural biota are vital for the recycling of organic wastes, degrading chemical pollutants, and purifying water and soil* (Pimentel et al., 1980). Further, *they are the essential reservoirs of genetic material for agriculture and forestry.*

Table 3. Land resource requirements for construction of energy facilities that produce 1 billion kWh/yr of electricity for a city of 100,000 people (Pimentel et al., 1989).

Electrical Energy Technology	Land in hectares
Solar Thermal Central Receiver	800
Photovoltaics	600
Wind Power	2,700
Hydropower	13,000
Forest Biomass	330,000
Solar Ponds	9,000
Nuclear	68
Coal	90

Transition from Fossil to Solar Energy

Instead of relying on the finite supplies of fossil energy, research must be focused on ways to convert solar energy into usable energy for society. Many solar energy technologies already exist, including solar thermal receivers, photovoltaics, solar ponds, hydropower, as well as burning biomass vegetation. Using some technologies, biomass can be converted into the liquid fuels, ethanol and methanol (ERAB, 1981, 1982).

As recently as 1850, the United States was 91 percent dependent on biomass wood or solar power for energy (Pimentel and Pimentel, 1979). Gradually that has changed until today we are 92 percent dependent on fossil energy while biomass energy makes up only 3 percent of the fuel we use (Pimentel et al., 1984).

Looking to the future, reliance on biomass energy use will grow and again become one of our dominant forms of solar energy (Pimentel et al., 1984). However, use of biomass has major limitations. Consider that the total amount of solar energy captured by vegetation each year in our country is about 13×10^{15} kcal (Pimentel et al., 1978). This includes all the solar energy captured by agricultural crops, forests, lawns, and natural plants. According to all estimates this yield cannot be increased to any great extent (ERAB, 1981).

Furthermore, the total solar energy captured by our agricultural crops and forest products is about 7×10^{15} kcal or slightly more than half the total solar energy captured (ERAB, 1981). Because this portion of biomass energy provides us with

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food, fiber, pulp, and lumber, it cannot be burned or converted into biomass energy.

Another factor to consider is that only 0.1 percent to 0.2 percent of the total solar energy per hectare can be harvested as biomass in the temperate region (Pimentel et al., 1984). This is because solar energy is captured by plants only during their brief growing season and for three-quarters of the year most plants are not growing (ERAB, 1981). To solve this problem will necessitate the use of relatively large land areas and large capital equipment investments for conversion of the energy into usable form.

This same biomass vegetation provides the food and shelter for a wide variety of important natural biota that help keep our natural environment healthy. Some species recycle wastes and nutrients, others help clean our air, soil, and water of pollutants. Without sufficient biomass these essential processes would stop.

Yet at our present population level, to sustain our lives and activities we are burning 40 percent more fossil energy than the total amount of solar energy captured by all plant biomass (ERAB, 1981). Clearly, our consumption of resources, especially nonrenewable fossil fuels, is out of balance with our supplies. The plain fact is that we are depleting these resources at an alarming rate and we now need to find and develop other energy sources.

Because almost three-quarters of the land area in the United States is devoted to agriculture and commercial forestry (USDA, 1987), only a relatively small percentage of our land area is available for harvesting biomass and other solar energy technologies to support a solar energy-based U.S. economy.

The inevitable conclusion is that *the availability of land will be the major constraint to the expanded use of solar energy systems* because land is needed for solar energy, and this need cannot encroach on that needed by agriculture, forestry, and natural biota in the ecosystem. Our expanding human population can be expected to put increasingly great pressure on land availability and use.

The amount of land required to provide solar-based electricity for a city of 100,000 people illustrates the land constraints. To provide the needed 1 billion kWh/yr from wood biomass would require maintaining 330,000 hectares of permanent forest (Table 3). Even hydropower is, in part, land based, because on average it requires 13,000 hectares of land for an adequate size reservoir. Then too, the land used for the reservoir is often good, productive agricultural land (Pimentel et al., 1984). Thus, solar energy and hydropower have serious land and environmental limitations. Note that nuclear and coal-fired power plants, including mining, require relatively small areas of land compared to biomass and hydropower production.

Unfortunately, *the conversion of biomass like corn into energy such as liquid fuels requires enormous inputs of fossil energy.* For example, about 1.5 liters of oil equivalents are used to produce 1 liter of ethanol equivalents (ERAB, 1981; Pimentel et al., 1988). Thus, under optimal conditions only about one-third of the biomass can be converted into valuable liquid fuels (Pimentel et al., 1988). Even if we quadrupled the efficiency so that 1 kcal of fossil energy produced 2 kcal of ethanol, about 10 acres of corn land would be required to fuel one U.S. automobile per year (Pimentel et al., 1988).

If we make the optimistic assumption that the amount of solar energy used today could be increased about 3- to 10-fold without adversely affecting agriculture, forestry, or the environment, then from 3 to 10 x 10^{15} kcal of solar energy would be available (Pimentel et al., 1984; Ogden and Williams, 1989). This is one-fifth to one-half the current level of energy consumption in the United States, which is about 20 x 10^{15} kcal and averages 8,000 liters of oil equivalents per capita per year (USBC, 1988). One possibility is that fusion energy will eventually be developed and make up the shortfall. The odds for this happening in time are about 1 in 1,000 (Mataré, 1989), and further, the intense heat its production generates would have to be overcome.

Toward a Sustainable Agriculture

Analyzing the 1100 liters of oil we now use to produce food on one hectare of land suggests ways

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we might decrease that fossil-based energy expenditure. Both fertilizers and pesticides are lost or wasted in agricultural production. For instance, about $18 billion per year of fertilizer nutrients are lost as they are eroded along with soils (Pimentel, 1989). Further, livestock manures, which have 5 times the amount of fertilizer nutrients used each year, are underutilized, wasted, or allowed to erode along with the soil. Much fossil energy could be saved if effective soil conservation methods were to be implemented and manures were used more extensively.

Another waste occurring in agriculture that affects energy use can be attributed to pesticides. *Since 1945 the use of synthetic pesticides in the United States has grown 33-fold, yet our crop losses continue to increase* (Pimentel et al., 1990). More pesticides have been used because agricultural technology has drastically changed. For example, crop rotations have been abandoned for many major crops. Now about 40 percent of our corn acreage is grown continuously as corn and this has resulted in an increased number of corn pests. Despite a 1,000-fold increase in use of pesticides on corn-on-corn, corn losses to insects have risen 4-fold.

Improved agricultural technology and a return to crop rotations would stem soil erosion, conserve fertile land, reduce water requirements for irrigation, decrease pesticide and fertilizer use and thereby save both fossil fuels and water quality. *The use of more land to produce food reduces the total energy inputs needed in crop production and would make agriculture more solar energy dependent and sustainable.* For example, instead of raising a given crop on one hectare with an energy input of about 1100 liters of oil, the use of two hectares for the same crop would make possible a reduction in energy inputs from 50 percent to 66 percent (Pimentel et al., 1988).

This of course assumes the availability of sufficient land, and a halving of yields per hectare. Some estimates suggest that if losses, waste, and mismanagement were eliminated, we would be able to produce present yields of food on the same amounts of land with one-half the energy outputs, and still have a more sustainable system (Pimentel et al., 1989). This should probably be considered an upper boundary. Since arable land cannot be much expanded, and since we already have hypothesized the diversion of some land to solar energy uses, *prudence would suggest that in planning any such shift to sustainable practices we anticipate lower yields and lower total production.* This, in turn, forces a choice between a smaller population, or a less well fed one.

Prosperity and Population

If the United States were to move to a solar energy-based economy and become self-sustainable, what would be our options and levels of prosperity? With a self-sustaining solar energy system replacing our current dependence on fossil energy, the energy availability would be one-fifth to one-half the current level. Then if the U.S. population remained at its present level of 246 million, a significant reduction in our current standard of living would follow. This would occur even if all the energy conservation measures known today were adopted.

If, however, the U.S. population wishes to continue its current high level of energy use and standard of living and prosperity, then its ideal population should be targeted at 40-100 million people. With sound energy conservation practices and a drastic reduction of energy use per capita to less than one-half current usage, it might be possible to support the current population. One projection suggests a significantly lower population level and the other a dramatic reduction in the standard of living. On the positive side, however, we do have sufficient fossil energy, especially coal, to help us make the needed transition in energy resources and population numbers over the next century, if we can manage the environmental impacts.

Conclusion

At present levels of fertility and migration, the U.S. population will rise one-third by 2080. A modest increase in fertility could drive it past a half billion. We could be heading eventually toward population densities like those in present-day China. Comparisons to China

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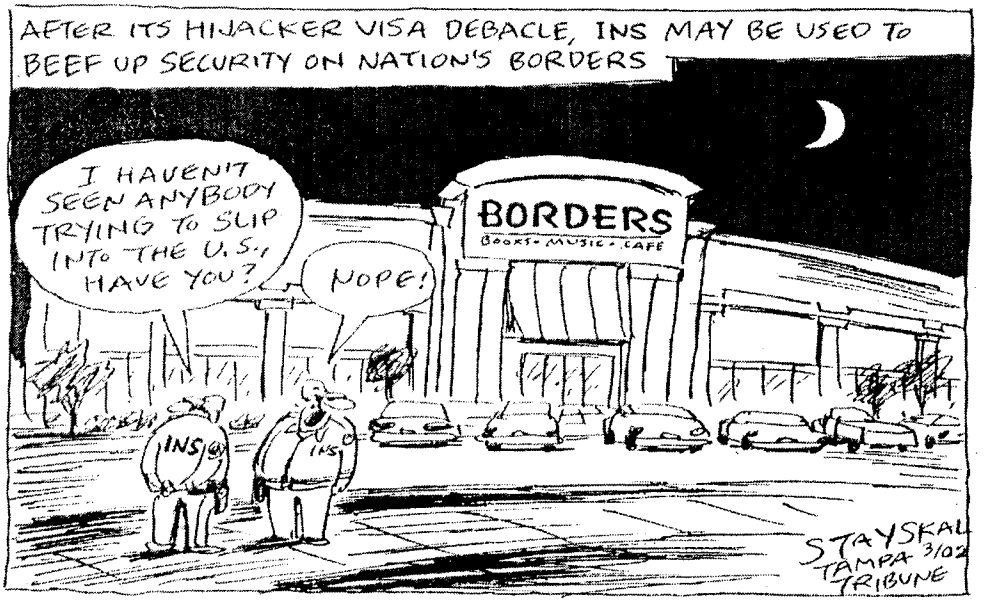
clearly emphasize why the United States will be unable to maintain its current level of prosperity and high standard of living, which is based on its available land, water, energy, and biological resources. We know that supplies of fossil energy, a nonrenewable resource, are being rapidly depleted. In just a few years, most U.S. oil resources will be consumed. Fortunately, natural gas reserves will last for nearly 50 years will coal reserves will carry us beyond the next century.

Therefore, we must start now to make the slow transition from our dependence on fossil fuels to development of solar energy power as our major energy resource. For the United States to be self-sustaining in solar energy, given our land, water, and biological resources, our population should be less than 100 million – significantly less than the current level of 246 million. However, with a drastic reduction in standard of living, the current population level might be sustained. With planning and determination the United States could gradually reduce its numbers to more manageable levels.

The available supply of fossil fuels, especially coal, will provide the time we need to make the necessary adjustments involving new solar energy technologies and agricultural practices. Coupled with this, Americans will have time to change their behavior and respect for natural resources and the environment.

With a population of 40 - 100 million, the United States could become self-sustaining on solar energy while maintaining a quality environment, provided that sound energy conservation and environmental policies were in effect to preserve soil, water, air, and biological resources that sustain life. With these far-reaching changes, we feel confident that future generations of Americans would be able to enjoy prosperity and have a high standard of living. Starting to deal with the future before it reaches crisis level is the only way we will be able to avert real tragedy for our children's children. By education, fair population control, sound resource policies, the support of scientific research, and all people working together, Americans will be able to face the future with optimism and pride. ■

[*Editor's note: In the interest of space, footnotes are not printed here but are available by contacting the offices of The Social Contract Press.*]


AFTER ITS HIJACKER VISA DEBACLE, INS MAY BE USED TO BEEF UP SECURITY ON NATION'S BORDERS
I HAVEN'T SEEN ANYBODY TRYING TO SLIP INTO THE U.S., HAVE YOU?
NOPE!
BORDERS
BOOKS • MUSIC • CAFE
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The Green Revolution

Its demographic and environmental consequences

by David Pimentel and Marcia Pimentel

Humans, like other animals, appear to have an innate drive to convert a maximum amount of their resources, including food, into themselves and their progeny. As a result, the rapidly growing human population is increasing pressure on agriculture and its vital supporting resources (land, water, energy, and biota) (Pimentel, 1987). Although all of these resources have finite limitations, all, except fossil energy, are renewable if they are managed properly.

Despite new agricultural technologies, including the Green Revolution, and the fact that most arable land in the world is already in agriculture, a scarcity of food and essential nutrients exists for some people in all nations. The situation is especially acute in the developing countries. Estimates are that of the more than 5 billion humans that now exist in the world, from 1 to 1.5 billion are malnourished (Latham, 1984; Sivard, 1987; Pimentel, 1989). In addition to food shortages, the quality of life for this 10 to 30 percent of the world population is diminished or threatened by insufficient, clean water, shelter, health care, and satisfying employment.

Productive agricultural programs and ample nutritious food supplies are fundamental to the social structure and economy of all nations. Some have hypothesized that development, including agricultural development, is essential to reducing population growth (Simon and Kahn, 1984). In this paper the role of agriculture as a solution to the population and environmental problem is examined.

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World Population Growth

For 99.9 percent of the more than 1 million years that humans have inhabited the earth, the maximum world population was less than 6 million – fewer than the present population of New York City. Population growth during this long period was only about 0.001 percent per year. During most of this time span, humans were hunter-gatherers and depended on their nearby environment to supply food and other basic needs. Without conventional economic development, they managed to stabilize their numbers at a level that was balanced by the availability of their resources (Douglas, 1966; Harris, 1977).

When people began to cultivate food crops about 10,000 years ago, some of the limitations and uncertainties formerly imposed by nature were reduced. The larger, more stable food supply resulting from the newly developed agricultural techniques (Brown et al, 1985) contributed to and supported a slow, steady growth of the world population (Deevy, 1960; Coale, 1974; Paddock, 1983) (Figure 1).

At the dawn of the industrial revolution in 1700, the world population stood at less than 1 billion. By 1900 the numbers had increased to about 1.6 billion. Over that entire 200-year period the average annual rate of population growth never exceeded 0.5 percent per year.

The major increase in the population growth rate that occurred during the last 200 years coincided with the discovery and use of stored fossil energy

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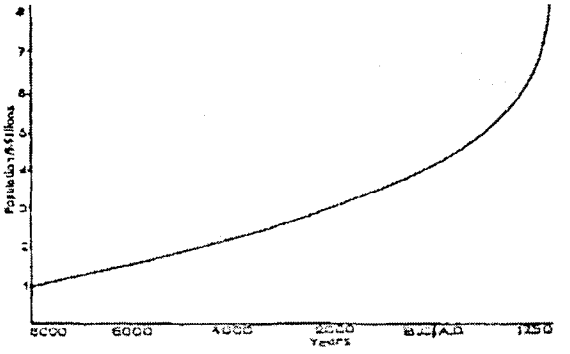
resources such as coal, oil and gas. Since then, the increased rate of population growth has closely paralleled the increased use of fossil fuel (Figure 2). Fortunately, the worldwide production of food has been growing at a rate equal to the growth in world population (Hudson, 1989). The fossil energy resources have enabled humans to make fertilizers and pesticides as well as substitute mechanical energy for human energy. These advances have facilitated the increases in food production that the human population requires. Also contributing to the rapid population growth was the use of energy to control human diseases by helping humans to secure safe drinking water, controlling malaria and schistosomiasis, and treating various microbial diseases with various drugs (Pimentel, 1987).

Figure 1. World population growth after the introduction of agriculture about 10,000 years ago. The population numbered only about 1 million at the discovery of agriculture (Deevey, 1960; Coale, 1974).



The current world population stands at greater than 5 billion (PRB, 1987). Never in history have humans, by their sheer numbers, so dominated the earth and its resources. Demographers project that the world population will reach 6.1 billion by the year 2000, approach 8.2 billion by 2025 (UN, 1982), and probably reach 12 billion by the year 2100. Present, there seems to be no generally accepted way to limit this growth (NAS, 1971, 1975).

More alarming than sheer numbers is the status of the annual population growth rate. Around the beginning of the twentieth century the rate of population growth increased sharply, first to 1 percent, and then to 1.5 percent, and eventually to 2 percent per year. The rate of increase peaked in the 1970s and at present has begun to decline very slowly. However, in 1988 the growth rate is still about 1.7 percent or about 1,700 times greater than it was during the first million years of human existence.

In addition to the actual rate of growth, there is the age-structure that presently exists in the world population. A large proportion of the world population (e.g., 45 percent of Africa, 40 percent of Latin America, and 37 percent of Asia) is now within childbearing age (PRB, 1987). In the long term this young age-structure will sustain the rapid population growth rate. For example, with more than half of the Chinese below the age of 20 years, even limiting births to one child per couple will not stop China's population growth (Coale, 1984). If 70 percent of the couples have only one child, the current population of slightly more than 1 billion (Coale, 1984) will still reach 1.2 billion by the year 2000 (Wren, 1982; Zhao, 1982). As a result, the number of Chinese added during the next 20 years will almost equal the present U.S. population. As mentioned, similar situations exist throughout the developing world, and the inevitable result would be continued growth for 60 years or more in the world population even if zero population growth were adopted immediately.

Increased economic development is frequently cited as a possible solution for high birthrates (Floud, 1985). However, except for Japan, Korea, Taiwan, and Singapore, where the economy depends on industry and trade, most overpopulated countries have insufficient natural resources to support economic development similar to that in Europe and North America (Keyfitz, 1984; Hardin, 1986). In fact, most of the 183 nations in the world now must import some food (FAO, 1985). Furthermore, and equally important, the "biological carrying capacity" of the ecosystem in many parts of the world already has been severely stressed and in some regions it has been exceeded (NAS, 1975; Brown et al, 1985; Pimentel,

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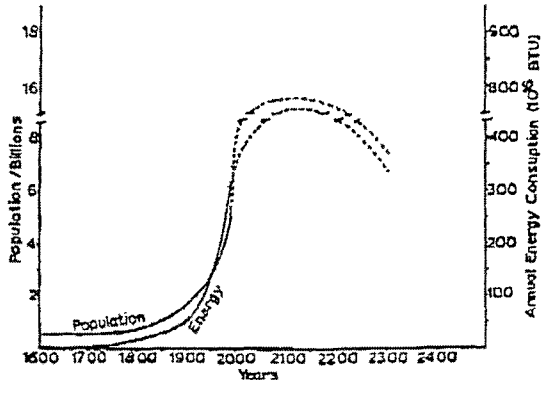
1987). For instance, the productivity of many arable lands is being degraded, water resources mined, forests destroyed, and biological diversity reduced.

Economic growth, including the Green Revolution, and prosperity cannot be relied on to control population growth. Clearly, an urgent need exists for all societies to consider methods to slow the growth of their human population (Reining and Tinker, 1975; Smuckler et al, 1988).

Figure 2. Rapid human population growth associated with fossil energy use. Estimated world population ( ) from 1600 to 1987 and projected numbers (-----) to the year 2300. Estimated fossil energy consumption ( ) from 1650 to 1987 and projected (-----) to the year 2300.



Population Growth and Food

Humans depend on adequate food supplies to provide them with the specific nutrients that they must have to sustain metabolism, growth, reproductive, and other vital life processes. The major nutrient needs are: carbohydrates; fats, amino acids, which are the building blocks of proteins; plus vitamins and minerals. These nutrients are needed in varying amounts depending on the age, size of individual, activity, physiological state (e.g., pregnancy), and disease burden. Therefore, the human food supply not only must be adequate in quantity, but adequate in the quality of its nutrient content.

Various guides have been compiled by nutritionists to serve as standards for evaluating how well food intakes or food supplies meet nutritional needs of individuals in population groups. The guide established by the Food and Agriculture Organization (FAO) recommends a daily energy intake of 3,000 kcal for a 65 kg moderately active male and 2.200 kcal for a 55 kg moderately active female. The recommended protein intake, consisting of animal and plant materials, is 41 g/day per person (FAO), 1973.)

If an individual does not meet the suggested intake, it does not necessarily follow that the person is malnourished. This is because the nutrient levels are set with sufficient margins to meet a wide variety of individual differences and needs. The allowances for nutrients are set above the minimum requirements that would prevent the development of specific nutritional deficiencies, like scurvy and pellagra.

For example, the pregnant female needs to increase her energy, protein, vitamin, and mineral intakes to insure her continued health and that of her offspring. Taking these nutrient needs into consideration, the nutrient level for protein increases from about 41 g to 76 g per day for pregnant women, while Vitamin C increases from 60 to 80 mg. and calcium increases from 800 to 1,200 mg per day (FAO), 1974.

The activity of a male or female also influences the nutrient needs of the individual. An adult male, for example, engaged in heavy work, such as tilling the soil by hand, may burn from 400 to 600 kcal/hr above his energy requirement for basic metabolism, and therefore will require increased food energy and additional vitamins per day to maintain his productivity during periods of strenuous labor (NAS, 1960).

Illness often increases the nutritional needs of the person (Anderson, 1979; Carmichael, 1985). For example, the nutrient needs of an individual who is infected with common parasites like ascarids or other parasitic worms will increase. In such cases the increase in nutrients offsets the food needs of the parasite population and the losses that occur if the parasite interferes with normal digestion and absorption processes. Sometimes more nutritious food is needed to counteract the blood and other body fluid losses associated with parasitic infections (Carmichael, 1985). All too often these types of

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problems occur in population groups that are already being stressed by malnutrition.

Malnutrition, diseases, and heavy farm work may combine to limit reproduction and population growth. In Africa, for example, male and female desire for many children to work on the farm may be constrained by low fertility and high infant mortality. In some segments of the African society, sterility rates are high owing to venereal disease, malaria, and other diseases (Valderrama and Moscardi, 1977; Boserup, 1981). Furthermore, rates of involuntary abortion in African women appear to be high in part because of disease and also because of the heavy agricultural work they do

Change in Agriculture and Population Growth History

The development of a structured agriculture over 10,000 years ago undoubtedly contributed to the growth in the world population (Figure 1) by providing an adequate and more stable food supply for the population than had existed when humans lived more precariously as hunter-gatherers (Deevey, 1960). However, Boserup (1965) has suggested that the growth in population numbers caused the change from hunter-gatherer to farmer; thus, agriculture was the result of population growth and not the cause. Both explanations have some validity and there probably was a positive feedback between population growth and agricultural technology. That is, the new, more stable food supply provided by early agriculture contributed to population growth. At the same time as the population grew, new agricultural techniques had to be developed and used to provide the required food supplies.

Early agriculture was a form of slash/burn agriculture (Ruthenberg, 1971). In this, an area near the campsite was burned over and seeds of some grain or other crops were planted. Several months later the early farmers returned to harvest the crop that remained after weeds, insects, plant pathogens, mammals, and birds had taken their share of the harvest. Usually the amount of food that was harvested was still greater than that obtained by searching the countryside for food. Over time the processes were refined and improved to enhance yields. Population groups became more settled, enabling them to devote more time and energy to control weeds and other pests. Estimates are that from 300 to 400 hours of humanpower per hectare were expended in a slash and burn operation for crops like corn. From 500 to 700 hours were devoted to weed control, especially in the second and third years of planting. Crop harvesting required up to 200 hours of labor per hectare (Pimentel and Pimentel, 1979). The total human labor input per hectare of corn production was about 1,200 hours (Lewis, 1951; Freeman, 1955). This is in sharp contrast to the present-day mechanized farming in the United States where only 10 hours of labor are expended per hectare for the total farming operation (USDA), 1985.)

Draft Animal Power

Because a human adult can produce from only 0.05 to 0.1 hph, the eventual use of draft animal power significantly reduced the human labor input. For example, the input of 200 hours of ox power reduced the human labor input about 800 hours per hectare (Pimentel and Pimentel, 1979). A horse, which is faster and more efficient than an ox, has a greater capacity to reduce the labor input in agriculture than does an ox.

Currently in China, where horses still are used in agricultural production, the human labor input remains high. For example, the labor input for corn and rice production in northeastern China ranges from 1,300 to 3,000 hours plus a horse input ranging from 330 to 440 hours per hectare (Wen and Pimentel 1984). The use of draft animal power increases the efficiency of farming by helping the farmer prepare farmland in a timely fashion for planting. This facilitates a more effective use of seasonal rainfall and/or favorable temperature conditions.

Family Size Related to Farm Size

One anticipated benefit from the substitution of animal power for human power could be the reduction in family size. Unfortunately, no assessment has been made of the number of children in families who farmed by hand versus those that farmed with draft animal power.

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Generally, farmers who used some draft animal power were able to increase the land tilled and planted and thus have larger farms. The only available data on the relationship of farm size and family size are those of by Kabir and Chowdhury (1982), who reported that in Bangladesh farmers with large acreages also had large families. Perhaps the larger families were needed to cultivate crops on the larger farms.

In general, farmers in both developed and developing countries have larger families than city dwellers (NAS, 1971, 1975; Easterlin, 1976; Knodel, 1977; Coale, 1984; Coale and Watkins, 1986). If, as in the United States, farmers make up only 2 to 3 percent of the population, then the larger farm families will minimally alter the demography of the nation. However, in many developing nations, where from 70 to 80 percent of the population earns a living from agriculture, large families will contribute significantly to rapid population growth of the nation.

Although all members of farm families generally assist with crop and livestock culture, distinct differences exist in the social structure of farm families located in various regions of the world. In Africa, for instance, nearly all the agricultural work is carried out by women and children (Boserup, 1981; Fortmann, 1989). Children, even the very young, are used to keep pest birds and other animals from the crops. They also pull weeds and care for small numbers of livestock. Thus, it is clear that self-employed farmers have a wide range of opportunities to exploit their children on the farm (Schultz, 1971).

Also, young African males help clear land for long-fallow cultivation. Thus, the male head of family, who has an adequate number of sons, does not need to hire additional labor and does not have to fear for lack of support in his old age (Boserup, 1981). For this reason, large families are considered the ideal in the rural areas of Africa.

In contrast to Africa, men dominate the farming systems in Asia and South America. The men usually do the heavy work like plowing, while women and children are relied on for the lighter work of weeding crops and tending animals.

Earlier it was mentioned that families managing large farms usually have large families. In addition, the incomes earned by farmers who own large farms are likely to be nearly double those of farmers who own small farms (Coale and Hoover, 1958). Generally, the landless earn less money than the landowner of a small farm. It is logical to assume, however, that the very poor farmer will have less adequate food and health care than the more affluent farmer. Thus, infant and child mortality is likely to be higher in poor farm families compared with the affluent farm families (NAAS, 1971, 1975). For this reason, their ultimate family size may be slightly smaller than that of the affluent farmer.

The benefits and costs of raising children are difficult to assess for any culture, but in rural areas children are usually a greater benefit than their cost (NAS, 1971, 1975; Cavalli-Sforza, 1986; Watts, 1987). Because a male child of 14 can earn an adult wage, he is a major asset to the family on or off the farm (Watts, 1987). This emphasizes another important factor, the special value placed on male children by farm families. The economic advantages of male children have led to female infanticides in some rural areas of the world (Boserup, 1981). Sometimes the female children are just neglected and allowed to die.

Children, especially males, provide substantial help on the farm after they reach 3 years of age. As adults they provide social and economic security for their parents when they are too old to work (Boserup, 1981). Throughout history, children have provided the major support for aged parents.

For the poor in many developing countries, maintaining a child costs less than buying and feeding draft animals. The only cost for a child in rural areas is its care and its food supply (grown on the farm) for the first 3 to 4 years. After this the child can pay for itself by working in the farming operation. In contrast, a draft animal like a water buffalo may cost about $100 to purchase and still have to be fed and cared for; note, a farmer's total annual income may be only $100 (ADAM, 1978; Pimentel unpublished).

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Green Revolution and Population Growth

Much has been said about the benefits and costs of the Green Revolution for developing countries (Dahlberg, 1979; Baum, 1987; Swaminathan, 1987). In general, large farmers who owned good quality bottom land benefited from the Green Revolution, while small farmers who were working marginal land in the hills benefited very little or not at all from the new technology (Prahladachar, 1982; Khan, 1984). Farmers on bottomland usually produced high-yielding crops like rice, whereas those on marginal land, which has lower yields and lower economic returns, were producing crops like cassava.

A different set of technologies must be developed for farmers if they are to be productive on the marginal lands (Baum, 1987). This is in part the reason for growing interest in fostering agroforestry on sloping lands and other marginal lands (Pimentel et al, 1989).

An agroforestry technology that combines the culture of crops and trees/shrubs helps protect the land, water, and biological resources while it increases food and fuelwood production on the land (Pimentel et al, 1989). Although more research is needed, it has been demonstrated that by using agroforestry techniques crop yields can be doubled or tripled, and additionally significant amounts of fuelwood can be produced for the family. Fortunately these economic benefits can be achieved while protecting the natural resources and sustaining the environment (Pimentel et al, 1989).

In general, the Green Revolution and the use of agroforestry technologies in agricultural development have required an increase in the size of the farm labor force and also in the total labor input per hectare (Hayami and Ruttan, 1971; Kikuchi and Hayami, 1983; Chadha, 1984; Pimentel et al, 1986, 1989). Unfortunately, during this increase in labor, the percentage of landless laborers also increased sharply (Bhalla, 1984). Concurrently, as labor on farms increased, population growth escalated.

Available data strongly suggest that children are an advantage in farming, and this advantage exists whether the agriculture is hand-powered, draft animal-powered, or tractor-powered mechanized farming. Agricultural development generally contributes to rapid population growth because farmers recognize that large families provide cheap labor. Thus, agricultural development alone does not appear to have provided a solution to the population growth problem.

Green Revolution and the Environment

By most standards everyone would judge the Green Revolution a resounding success (Baum, 1987). However, in terms of the impact it has had on the environment, the Green Revolution has not been successful (Swaminathan, 1987). The Consultative Group on International Agricultural Research (CGIAR) that developed the crop plant improvements paid little or no attention to how this new technology would affect the quality of the environment (Baum, 1987).

Some of the Green Revolution crops that were developed were susceptible to insect pests and required stepped-up insecticide use (Pradhan, 1971; Barr et al, 1975; Oka, 1976). Pesticide use in Green Revolution rice production, for example, was reported to increase seven-fold over levels used in traditional rice production (Subramanian et al, 1973). To date, no evaluation has been made of the precise impact the increased use of insecticides has had either on agroecosystems or the surrounding natural ecosystems. Many insecticides used not only are known to be toxic to humans, but also kill beneficial natural enemies of pests in the treated crops and adjoining crops (Pimentel, 1983) Further insecticide resistance developed in the brown plant hopper associated with rice and this reduced rice yields and increased insecticide use (Oka, 1987). Then, too, insecticides have killed the shrimp and fish in rice paddies that are important sources of food for the poor. The spread of insecticides into the aquatic environment has contributed to the increased resistance observed in mosquito populations and has resulted in the spread of malaria in Asia, Africa, and Latin America

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(ICAITI, 1977).

In addition to heavy reliance on pesticides, fertilizer requirements of Green Resolution crops increased in some cases 20- to 30-fold (Wen and Pimentel, 1984; Wittwer et al, 1987). While long experience has demonstrated that their heavy use contributes to eutrophication, this aspect of the Green Revolution has not been studied.

Other notable difficulties with the Green Revolution are the alarming soil erosion and water run-off problems (Pimentel et al, 1987). Although erosion might be more serious in green revolution than in traditional farming, erosion and associated run-off are especially serious farming problems because they decrease the productivity of the land. Then the reduced productivity requires added fertilizer, irrigation, and pesticides to offset soil and water degradation. This starts a cycle of more agricultural chemical usage and further increases the production costs the farmer must bear.

Poorer farmers are finding that they are unable to afford the needed fertilizers and pesticides for the Green Revolution crops. It seems unlikely that agricultural development will substantially reduce family size or slow population growth in developing countries.

Conclusion

Agricultural development itself has never slowed population growth in the history of human societies. All available evidence suggests that it will not provide a solution to this serious problem in the future.

Farm families generally are much larger than families in urban areas. Children are cheap to raise and care for in rural areas. Indeed, children often are less expensive than the best draft animals and for this reason are commonly exploited in developing country farming. A large family of children provides economical farm labor, as well as economic security for the parents as they grow older. This is especially true for farmers with small acreages and landless farmers.

There is no indication that the size of Green Revolution farms, whether large or small, will curtail the rate of population expansion – population growth will probably continue at a rapid rate in rural areas. If a nation could industrialize while agricultural development occurs, then although the farms might increase in size, the labor released from farming could be absorbed by the industrial sector.

Of course, one has to ask another question: How many developing countries can industrialize like Japan, Korea and Singapore? Further, are there sufficient markets for TVs, automobiles and other material goods to support a work force comprised of 80 to 90 percent of the population currently employed in agriculture in developing countries?

Humans now face an enormous dilemma – should the population goal of the world be about 1 billion people who enjoy a high standard of living characteristic of the industrialized nations of the west or 15 billion who must survive at the poverty level? About 200 years of careful planning and dedication to population control will be needed by each nation to reduce its numbers by 80 percent and achieve a world population of about 1 billion. Most would agree that the reward is great for both countries and individuals. If achieved, then there would be abundant food, a sustainable agriculture and environment, plus a relatively high standard of living for everyone.

Without planning and sacrifice, we are on the road to 15 billion humans or more! To provide minimal food needs will mean that most forests will have to be removed and planted to crops (more than half of the world forests have already been destroyed during the past 30 years), natural grasslands converted to pastures and/or crops and some mountainsides terraced for crop production.

Nature has always limited all biological populations in the past and will do so with human populations, if individuals and nations do not find ways to limit their numbers to the "carrying-capacity" of the earth. Already many natural environments vital to human survival have been destroyed beyond repair. ■

[*References may be obtained by contacting the offices of The Social Contract Press, 1-231-347-1171.*]

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Food, Energy, & Society: Options & Solutions

by David Pimentel and Marcia Pimentel

Tough questions about conservation of natural resources, development of alternative energy resources, desired standards of living, types of diet, and optimum population size must be answered. All require decisive action.

The foremost question is how humans will be able to provide a nutritionally adequate diet for a world population expected to be more than 6.1 billion by 2000 and 12 billion by about 2040.

Food security for all is dependent on and interrelated with many factors within the vast human social and ecological system. Fundamentally, it depends upon human population numbers and the standard of living those humans desire. Environmental resources such as arable land, water, climate, and fossil energy for fertilizers and irrigation influence the outcome. The food supply is also affected by crop losses to pests, availability of labor, environmental pollution, and the health and lifestyle of the people. Distribution systems and the social organization of families and countries play a role in the solution.

David Pimentel and Marcia Pimentel. *Chapter 21, "Summing Up: Options and Solutions," from David Pimentel and Marcia Pimentel, editors,* Food, Energy, and Society, *revised edition. Niwot, CO: University Press of Colorado, 1996. Reprinted from* FOCUS, *Vol. 7, No. 3, 1997 BY PERMISSION OF Carrying Capacity Network, 2000 "P" Street, Suite 310, Washington, DC 20036, (202) 296-4548.*

Future Food Needs

For about a million years, the human population growth rate was slow, averaging only about 0.001 percent per year. During that long period of time, the world population numbered less than 10 million (Keyfitz, 1976). Growth in human population numbers began to escalate about 10,000 years ago, when agriculture was first initiated. Rapid population growth, however, only started after the year 1700, when it accelerated to today's rate of 1.7 percent per year, about 1700 times the historical rate of 0.001 percent (NAS, 1975; Keyfitz, 1976; PRB, 1993). World population now stands at 6 billion and is expanding at a quarter million persons per day. Unless unforeseen factors intervene, it will reach more than 6.1 billion by 2000 (PRB, 1995) and about 12 billion by 2040 or so. Growth is not expected to end until after the year 2100.

The rapid growth in the world population has already resulted in an increased need for food. Estimates are that today from 1 to 2 billion people, or approximately 25 percent of the world population, are seriously malnourished.

Population Health

Rapid growth in the world population coincided with the exponential growth in the use of fossil fuels (Figure 21.1). Some of this energy has been used to promote public health, control disease, and increase food production for the ever-growing world population. The control of typhoid disease, for example, was achieved by improving water purification, which required large energy expenditures (Audy, 1964). The program for eradicating malaria-carrying mosquitoes required the application of DDT and other insecticides. Producing these insecticides used substantial quantities of energy (Audy, 1964).

Reduction in death rates through effective disease control has been followed by substantial increases in population growth rates. For example, in Sri Lanka (Ceylon), after spraying mosquitoes with DDT, the death rate fell from 20 per 1000 in 1946 to only 14 per 1000 in 1947 (PEB, 1955), and population growth

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rates concurrently increased. A similar dramatic reduction in death rates occurred after DDT was used in the island of Mauritius, where death rates fell from 27 to 15 per 1000 in one year, and population growth rates increased from about 5 to 35 per 1000 (Figure 21.2),

Historical evidence documents many similar occurrences in nations where public health technology improved sanitary practices and medical supplies have significantly reduced death rates (Cors and Oakley, 1971). The effective control of human diseases, coupled with increased food production, has contributed significantly to rapid population growth (NAS, 1971). Unfortunately, the immediate increase in family size and explosive population increase in cities, town, and villages all too often overwhelms existing food, education, health, and social systems (NAS, 1971).

The presence of some chronic disease also increases the need for food. For example, when a person is ill with diarrhea or malaria or is infested with a parasite such as hookworms, anywhere from 5 to 20 percent of the individual's energy intake is expended to offset the illness. With malaria, hookworms, and amoebic dysentery, the parasite removes blood and nutrients and reduces the individual's ability to make effective use of his food.

Food Losses

Significant quantities of our food supply are lost to insects, plant pathogens, weeds, birds, rodents, and other pests. World crop losses due to pest infestation are estimated to be about 40 percent (Pimentel, 1991). These losses include destruction by insects (15 percent), plant pathogens (12 percent), weeds (12 percent), and mammals and birds (1 percent). Although mammal and bird losses are more severe in the tropics and subtropics than in the temperate regions, they are still low compared to those attributed to insects, pathogens, and weeds.

"The major pests that destroy harvested foods are microbes, insects, and rodents. When post-harvest losses are added to pre-harvest losses, total food losses due to pests rise to an estimated 50 percent."

In addition, available evidence tends to suggest that some Green Revolution technologies have intensified losses to pests (Pradhan, 1971; I.N. Oka, Bogor Food Research Institute, Indonesia, personal communication, 1991). Some of the new high-yielding crop varieties exhibit greater susceptibility to some pests than do traditional varieties. In the past, farmers saved seeds from those individual plants that survived and yielded best under local cultural conditions and planted them in subsequent years. These genotypes were naturally resistant to pest insects and plant pathogens and competitive with weeds. In this way, farmers developed genotypes that grew best in their localities.

The newly developed grain varieties have more genetic uniformity, and this can become a distinct disadvantage when the variety is planted over large areas in a new environment. Such plantings provide an ideal ecological environment in which the plant pathogens can evolve highly destructive genotypes (Frankel, 1971; I.N. Oka, Bogor Food Research Institute, Indonesia, personal communication, 1991). Concurrently, programs have been developed for multiple cropping in an effort to increase food supplies from limited land resources. This type of continuous crop culture has resulted in increased pest outbreaks (Pathak, 1975). Higher crop losses to pest damage mean lower yields and less food.

Not all losses occur during the growing season; substantial post-harvest losses occur. These are estimated to range from 10 percent in the United States to a high of 25 percent in many developing countries. The major pests that destroy harvested foods are microbes, insects, and rodents. When post-harvest losses are added to preharvest losses, total

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food losses due to pests rise to an estimated 50 percent. Thus, pests destroy about half of the potential world food supply. We cannot afford a loss of such magnitude when faced with an increasing need for food to feed the growing world population.

Strategies for Meeting Food Needs

Two-thirds of the world's people consume primarily a vegetarian-type diet. These individuals eat about 200kg of grain products yearly. They consume this grain directly and eat little food of animal origin. In contrast, the remaining one-third of the world's people, including those living in industrial countries such as the United States, consumes about 360kg of animal food products yearly (Putnam and Allshouse, 1991). To produce this amount of animal food in the United States, about 655kg of grain per person are raised and then fed to animals (Putnam and Allshouse, 1991).

About 141 million tons of plant and animal protein are produced annually worldwide for human consumption. If evenly divided, this would provide about 64kg of protein per person per day. Of this total amount, animal protein (meat, milk, eggs, etc.) accounts for 34 percent, or about 44 million tons. Livestock, including poultry, in the United States alone number 6 billion and outweigh the human population by more than four times (Pimentel, 1990). Worldwide there are an estimated 20 billion livestock. These animals graze on 3.1 billion ha, or about 24 percent of the world land area (World Resources Institute, 1992).

To increase the production of animal protein, the process must be made more efficient than it has been in the past. This is especially relevant to livestock production. Overgrazing should be prevented and more productive pasture plant species developed and cultured. Applications of limited amounts of livestock manure and perhaps fertilizers would increase forage yields. The annual supply of animal protein could be increased from the present 44 million tons to about 50 million tons by the year 2000. The increase, however, would not be sufficient to maintain the present protein intake of 64g per person per day for the world population, which in the meantime will also have increased substantially.

Some estimates report that the fishery harvest is about 95 million tons. This is probably the maximum yield, considering the serious overfishing problems that already exist. In addition, fish production is energy-intensive; this energy has been and will continue to be a constraint on its expansion.

One way to increase food supplies is for humans to become more vegetarian in their eating habits. Annually, an estimated 40 million tons of grain protein suitable for human consumption are fed to the world's livestock. This represents 34 percent more protein that would be available as food for the world population if it were not cycled through livestock.

If the protein currently fed to livestock were instead fed directly to humans, then more food grains would be available for the world population. Assuming that improved management of livestock pasture and rangeland yielded an additional 25 million tons of livestock protein, then the increases needed in the following crops over a 20-year period would be: cereals, 41 percent; legumes, 20 percent; and other plant proteins, 50 percent. It is doubtful that these increases can be achieved. However, increased yields in plant crop production are more easily achieved than increases in animal production. Nevertheless. Just as livestock production is vital to humans today, it will be important to humans in the future. Cattle, sheep, and goats will continue to be of value because they convert grasses and shrubs on pastures and rangeland into food suitable for humans. Without livestock, humans cannot make use of this type of vegetation on marginal lands.

Energy Needs in Food Production

In past decades humans did not have to concern themselves about fossil fuel supplies, because relatively inexpensive and ample supplies were available. Such will not be the case in the twenty-first century. An estimated 17 percent of the fossil energy consumed in the United States is used in the food production system. This 17 percent may seem neither large nor important when considered as a portion of the total U.S. energy expenditure, but compared to that

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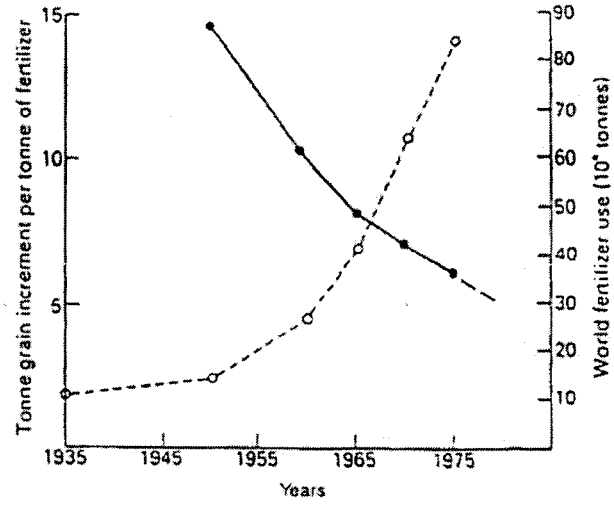
of other nations (especially developing countries) it is extremely large. It amounts to more than twice the per capita fossil fuel use in Asia and about four times that in Africa.

The following analysis may help clarify the relationships of fossil fuel supplies to production of food supplies. The total energy used annually in the United States for food production, processing, distribution, and preparation is about 1600 liters of oil per capita per year. Using U.S. agricultural technology to feed the present world population of 6 billion, a high protein/calorie diet for one year would require the equivalent of 9000 x 10^9 liters of fuel annually.

Another way to understand the dependency of food production on fossil energy is to calculate how long it would take to deplete the known world reserve of petroleum if a high protein/calorie diet, produced using U.S. agricultural technologies, were fed to the entire world population. The known world oil reserves have been estimated to be 87 a 10^{12} liters (Matare, 1989), so if we assume that 75 percent of raw oil can be converted to fuel (Jiler, 1972), this would provide a useable reserve of 66 x 10^2 liters of oil. Assuming that oil were the only source of energy for food production and that all known oil reserves were used solely for food production, the reserves would last a mere 7.3 years from today. This estimate is based on a hypothetical stabilized population of 5.5 billion. The reality is that each day an additional quarter million new mouths must be fed.



21.3 Declining grain yield increment per fertilizer input (——) (Brown, 1978) and world fertilizer use (– – –) in metric tonnes.

How then can food supply and energy expenditures be balanced against a growing world population? Even tripling the food supply in the next 40 years would just about meet the basic food needs of the 11 billion people who will inhabit the earth at that time. Doing so would require about a ten-fold increase in the total quantity of energy expended in food production. The large energy input per increment increase in food is needed to overcome the incremental decline in crop yields caused by erosion and pest damage. (Figure 21.3)

One practical way to increase food supplies with minimal increase in fossil energy inputs is for the world population as a whole to consume more plant foods. This diet modification would reduce energy expenditures and increase food supplies, because less food suitable for human consumption would be fed to livestock. With livestock, roughly 20 calories of increased energy are needed to obtain one calorie of food.

Land Constraints

Feeding a population of more than 6 billion a high protein/calorie diet using U.S. agricultural technology would require large areas of arable land. This will be the case even if only plant production is to be increased. Thus, it is important to know how much arable land now is available for use in agricultural production.

The United States, with a current population of 260 million people, has about 160 million ha planted to crops (USDA, 1991). This averages out to 0.6 ha per person. However, the cropland needed per American is only

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about 0.50, because 20 percent of our present crop yield is exported.

Worldwide, about 1.5 billion ha of arable land now exists for crops. Based on the present population of 6 billion, this averages out to be only 0.25 ha per person. Therefore, if at least 0.50 ha per person is needed to produce a U.S.-type diet, there is not sufficient arable land, even with the addition of energy resources and other technology, to feed the rest of the world on a U.S.-type diet.

In some regions it may be possible to bring some poor land into production. Best estimates are that cropland resources might be doubled to 3 billion with great cost, using large amounts of energy for fertilizers and other inputs. This increase in cropland would necessitate cutting down most forests and converting some pasturelands to cropland. Both changes would have negative impacts on biodiversity and production of needed forest products. Also, forest removal increases erosion, flooding, and other environmental damage (Pimentel et al., 1992a).

Worldwide, more than 10 million ha of agricultural land are abandoned annually because of serious soil degradation. During the past 40 years, about 30 percent of total world arable land has been abandoned because it was no longer productive. Loss of arable land is increasing because poor farmers worldwide have to burn crop residues and dung as fuel because firewood supplies are declining and fossil fuels are much too costly. It is expected that 750 million ha of cropland will be abandoned by 2050 because of severe degradation. This is extremely bad news; about half of the current arable land now in cultivation will be unsuitable for food production by the middle of the twenty-first century.

"Iowa, which has some of the best soils in the United States, reportedly has lost half its topsoil after little more than 100 years of farming."

Wind and water erosion seriously reduce the productivity of land. In the United States, the rate of soil erosion is estimated at 13 tons/ha annually. The United States has already abandoned an estimated 100 million has (Pimentel et al., 1995). At least one-third of topsoil has been eroded during more than a century of farming. Iowa, which has some of the best soils in the United States, reportedly has lost half its topsoil after little more than 100 years of farming (Risser, 1981).

So far, the reduced productivity of U.S. cropland due to erosion has been offset by increased use of fertilizers, irrigation, and pesticides. The estimate is about 50 liters of oil equivalents per hectare are expended each year to offset cropland degradation. In developing countries, the rate of soil loss is more than twice that of the U.S., an estimated 30 to 40 tons/ha/yr (Pimentel, 1993). Therefore, based on what we presently know, both the amount of arable land available for crop production and the amounts of extra energy needed to put poor land into production are serious constraints on expansion of crop production.

Water Constraints

Water is the major limiting factor in crop production worldwide because all plants require enormous amounts of water for their growth. For example, a corn crop will transpire about 4.5 million liters of water during the growing season (Leyton, 1983). If this water has to be added by irrigation, approximately 8 million liters of irrigation water must be applied. Another way of assessing water needs is to point out that 1400 liters of water are necessary for the production of 1kg of corn.

Indeed, agriculture is the major consumer of available water. In the United States, irrigated agriculture consumes (nonrecoverable) about 85 percent of the fresh water that is pumped, and the public and industry consume the remaining 15 percent (NAS, 1989a). Worldwide, agriculture uses about 87 percent of the fresh water pumped (Postel, 1989).

Only about 16 percent of the world's cultivated land is now

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irrigated (WRI, 1992). In the arid lands, various sectors of the economy have conflicting demands for available water. Agriculture must compete with industry and public use of water, because the economic yields from agriculture per quantity of water used are far less than economic yields from industry. The public always needs water to drink and for other personal uses.

"The changes wrought by irregularities of climate patterns call attention to interdependency of nations and the importance of cooperative planning."

Expansion of irrigation is further limited because it requires large amounts of energy. About 20 million kcal of energy is needed to pump 8 million liters of water from a depth of 30 m and irrigate by sprinkler system (Smerdon, 1974). This is more than 3 times the fossil energy input of 6 million kcal usually expended to produce 1 ha of corn (Pimentel, 1980). In addition, 13 percent more energy is required to maintain the irrigation equipment. These figures do not include the environmental costs of soil salinization or waterlogging often associated with irrigation.

High rainfall and/or the presence of too much water, or rapid water runoff, also cause serious environmental problems. The removal of forests and other vegetation, in particular on slopes, encourages water runoff and often results in serious flood damage to crops and pasture. In fact, environmental damages caused by floodwater, soil sediments, and related watershed damage are estimate to be about $6 billion per year (Clark, 1985).

Climate

Climate has always determined the suitability of land for cultivation of crops. For this reason, changes in temperature and/or rainfall can be expected to influence food production and supplies (Pimentel et al, 1922b). These two considerations must be evaluated on different time scales. Within any given decade, there are likely to occur irregularities in temperature and rainfall patterns that may either improve crop yields or inflict enormous damage to agricultural yields (for example, the drought that occurred in the United States in 1988) (USDA, 1989). However, long-term changes may have far more serious consequences. In particular, many scientists are concerned about global warming because of the greenhouse effect, which may affect agricultural production (Pimentel et al, 1922b). The sensitivity of crops to temperature change is illustrated with corn. For example, a mere 0.6°C increase in temperature would lengthen the growing season by about two weeks and increase crop yields. However, global warming would also reduce the amount of water available for crop production. On balance, global warming would have a negative impact on agriculture.

The changes wrought by irregularities of climate patterns call attention to interdependency of nations and the importance of cooperative planning. The effects of such irregularities also emphasize the need for the establishment of an international food reserve to offset years in which crop yields in the food-producing regions of the world are unexpectedly low.

Environmental Pollution

Numerous wastes produced by agricultural production are considered pollutants. These include fertilizers, pesticides, livestock manure, exhaust gases from machinery, soil sediments, odors, dust, wastewater, and crop wastes. Pesticide use in the world totals 2.5 million tons, yet insects, plant pathogens, and weeds will destroy about 40 percent of all potential food in the world. However, pesticides are important, for without them food losses would rise to about 55 percent.

Pesticides, however, also cause serious public health and environmental problems. Worldwide, about 3 million human people a year suffer from pesticide poisoning, with about 220,000 fatalities. In the United States there are about 67,000

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human pesticide poisonings per year with about 27 fatalities (Litovitz et al, 1990). In addition, there are as many as 10,000 cases of cancer associated with pesticide use (Pimentel et al, 1992c). In addition, fish, honeybees, birds and natural enemies are killed. The total environmental and health costs of using pesticides are estimated to be more than $8 billion per year (Pimentel et al, 1992d).

On the world scene, pesticide use in agriculture has contaminated water with pesticides and exposed mosquito populations to insecticides. The result has been the development of high levels of resistance to insecticides worldwide and an explosion in the incidence of malaria, which is now difficult to control (NAS, 1991). The various environmental problems associated with pesticides appear to be increasing worldwide (Pimentel et al, 1992c).

The Future

There is no single cause of the growing shortages of food, land, water, and energy or pollution of the environment, nor are there simple solutions. When all the world's resources and assets must be divided among an increasing number of people, each one has a smaller share, until there are insufficient amounts to go around.

At this point it is relevant to reconsider the biological law Malthus proposed: "First, that food is necessary to the existence of man. Secondly, that the passion between the sexes is necessary and will remain nearly in its present state ... Assuming then my postula are granted, I say that the power of population is definitely greater than the power of the earth to produce sustenance for man." Malthus may not have been thinking about this aspect, but it is true that food production increases linearly, whereas the human population increases geometrically. Therefore, there is no biophysical way for food production to increase and stay with the growth of the human population. Even if population increase were not geometric, there are limits to the earth's carrying capacity.

Perhaps Bertrand Russell (1961) best expressed the biological law related to population growth when he wrote: "Every living thing is a sort of imperialist seeking to transform as much as possible of its environment into itself and its seed." This law suggests that the human population will increase until food or some other basic need limits its survival and growth.

Although science and technology will help alleviate some of the future shortages, they cannot solve all the problems the world faces today. Science has been unable to solve many of the world's problems during the past 50 years, and with fewer resources that must be shared with more people we have no reason to expect that biophysical limits can be overcome. For example, more, larger and faster fishing vessels have not increased fish production; on the contrary, it is declining. Likewise, water flowing in the Colorado River now ceases to reach the Sea of Cortes. There is no technology that can double the flow of the Colorado and/or increase rainfall.

We remain optimists, for we see some signs that people are beginning to understand that resources are not unlimited and that a balance must be achieved between the basic needs of the human population and environmental resources, many of which are finite. This is the time to take action.

Above all else humans must control their numbers. This task is probably the most difficult one facing all of us today. If birth rates are to decline on a massive scale, parents must understand that having fewer children is in their own and their children's interest. This understanding can be achieved only if the direct costs of having children are increased and if socially acceptable substitutes for large families are developed. Within each country and each ecological system, difficult social changes must be encouraged in conjunction with policies that augment food supplies and improve health, education, and lifestyle.

What humans choose to do in the coming two decades will determine the kind of world the next generations will live in. Ultimately, it is up to each individual to reduce his or her reproductive rate. Clearly, if humans do not control their numbers, nature will do so through poverty, disease, and starvation. ■

[*References available at the offices of The Social Contract.*]

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Bad News on Fertility

by Lindsey Grant

The National Vital Statistics Report in July 2001 conveys a great deal of bad news about U.S. fertility in one dense little paragraph.

> *The total fertility rate (TFR) indicates the number of births that a hypothetical group of 1,000 women would have if they experienced, throughout their childbearing years, the age-specific birth rates observed in a given year. The TFR for 2000 was 2,133.5, a 3-percent increase over 1999 (2,075.0) and the highest TFR since 1971. TFRs increased between 1999 and 2000 for all racial and ethnic groups--from 1,850.0 to 1,887.0 for non-Hispanic white. from 2,146.5 to 2,183.5 for black, from 2,056.5 to 2,098.5 for American Indian, from 1,927.0 to 2,072.0 for Asian or Pacific Islander, and from 2,985.0 to 3,107.5 for Hispanic women...*

(These figures are per 1,000 women. The more usual and more easily understood formula is "per woman." Thus 3,107.5 translates to 3.1075 children per woman.)

What this means is that, at current fertility levels, the U.S. population would never stop growing, even if there were no immigration. And immigration has risen to over 1.2 million per year.

It also shows what "shifting shares" can do. The more fertile population groups become a larger proportion of the population (barring much higher mortality rates), and that in turn drives the total population up faster. By far the highest fertility, and the largest share of immigration, is Hispanic. In fact, Hispanic fertility in the United States is well above the average fertility of 2.92 in the "less developed countries" (UN medium variant) and – unlike fertility in the LDCs – it is rising. It is much higher than in Mexico, where it is about 2.5.

Fertility tends to be higher for the poor and less educated. That explains much of the difference between, say, Blacks and non-Hispanic whites. It is not sufficient to explain the high Hispanic fertility, which presumably has cultural roots.

These things can change, sometimes very suddenly. In Quebec, for instance, fertility plummeted dramatically – too far, perhaps – in a few years, despite complaints from political leaders and the church. Perhaps more Hispanic women will come to agree with most women in industrial countries that there is more to life than childbearing. Perhaps they will sense the increased crowding around them and the competition for jobs and wonder how many children they should be bringing into a changing world.

It is difficult for a non-Hispanic to say this to them. The charge of "racism" is immediately raised. They need leaders who will warn them that the growth they are generating hurts them, as Cuban-born George Borjas has warned with respect to immigration and as Richard Estrada did before his untimely death.

The Census Bureau expected U.S. fertility to rise, but not so fast. The new fertility rates are higher even than its "highest" fertility projections. Two years do not predict what will happen in 100 years, but that "highest series" leads to a population of 553 million in 2050 and 1.18 billion in 2100. That, I think, would be an unmitigated disaster. I will watch for the 2001 and 2002 figures with nervous interest.

Some Mexican-Americans take pleasure in what they describe as the "reconquest" of the land Mexico lost in 1848, but nobody gains from the growth that we face. Ethnic rivalry is a poor basis for fertility policy. I will propose a better ideal, and one that discriminates against nobody: the ideal of the two-child family – stopping at two – for everybody, of every group and religious persuasion. It would particularly benefit the poor, since by encouraging them to have fewer children it offers them, and society, the hope of

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bringing the children up to escape poverty. Because some women have one child or none, it would stop population growth even with a modest net immigration of something like 200,000. Within two generations, it would give us the happy choice of being able to decide how populous the country should be.

[Addendum by the author: *The preliminary 2001 data from the National Center for Health Statistics came out just before we went to press. Total fertility was a shade less than in 2000, not a statistically significant difference. The bad news is that Hispanic fertility rose 1.4 percent. The good news is that teenage fertility declined across all groups, which probably reflects greater teenage responsibility and which I hope may presage lower overall fertility in coming years. (The fertility rates – though not the total numbers of births – will go down somewhat when they are adjusted for the 2000 Census, which showed population growing faster than the Census Bureau had anticipated.)*] ■

The Coming End of Cheap Oil

To Hubbert's Peak and beyond

by John Attarian

Recently several petroleum geologists have predicted that within this decade, the world's annual output of conventional (easily accessed and extracted crude) oil will peak, then irreversibly decline. In Hubbert's Peak (reviewed in *The Social Contract*, vol. XII, no.2), an excellent, lucid text, Kenneth Deffeyes, a Princeton professor emeritus and former Shell Oil research geologist, makes a persuasive case that output will peak around 2005, give or take a few years.[1]

Confirming that resources are finite, this debunks the cornucopianism of the late Julian Simon. More importantly, the coming end of cheap oil has disastrous implications. It makes radical reforms, including an immigration moratorium, imperative.

Hubbert and His Followers

Deffeyes's analysis and title are inspired by Shell geophysicist and petroleum geologist M. King Hubbert (1903-1989), who over half a century ago first pointed out that fossil fuels (fuels derived from prehistoric organic matter-- coal, petroleum, natural gas, oil shale, etc.) exist in fixed, finite, and exhaustible quantity, and stated the necessary implications. In "Energy from Fossil Fuels" (1949), Hubbert noted that fossil fuels had accumulated over 500 million years, meaning that any quantity increase in the next 10,000 years would be nil. Beginning with the Industrial Revolution, man has consumed huge quantities of fossil fuels. Once burned, their energy is gone. "Hence, we are dealing with an essentially fixed storehouse of energy which we are drawing upon at a phenomenal rate." Hubbert wondered somberly how long this is sustainable. The supply at any given time equals initial endowment minus previous consumption; consumption is proportional to the area under the plot of annual extraction against time. Hubbert therefore announced "with certainty' that a plot of annual production of any fossil fuel against time "will rise, pass through one or several maxima, and then decline asymtotically to zero." While such a curve could have "an infinity of different shapes," in all cases the area under the curve – the amount produced – could at most equal the original quantity.[2]

This is the idea underlying the famous Hubbert curve. Clearly, it is what resource finiteness *necessarily* implies. Initial and final extraction of such

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a resource must be zero. In between, output must rise at first, then fall.

Hubbert estimated the world petroleum supply at roughly 320 billion cubic meters. At 100 billion barrels (hereafter Gb, for gigabarrels) per 16 billion cubic meters, this comes to 2,000 Gb of oil. Warning of fossil fuels' eventual exhaustion, Hubbert speculated that water power could replace then as an energy source. Release of energy from fossil fuels, he pointed out, is "unidirectional and irreversible," and "can only happen once." Hubbert concluded – correctly – that humanity's situation in the mid-twentieth century, with soaring total and per capita fossil energy consumption, and soaring population, was "precarious" and "among the most abnormal and anomalous" in world history. Neither reverting to a simpler way of life nor remaining in place was possible. Fossil fuel exhaustion was inevitable; even so, we might be able to stabilize world population at some "reasonable" level and sustain industrial civilization. Or we might simply continue until crises – overpopulation, resource exhaustion and decline – supervene.[3]

Hubbert's famous "Nuclear Energy and Fossil Fuels" (1956) pointed out that while initial rates of American and world production of coal and crude oil grew at exponential rates, because the resource supply is finite, "physical limits prevent their continuing to do so." This, of course, is just common sense. Recapitulating his earlier analysis, Hubbert presented a stylized graphical depiction of the mathematical relations of the production cycle of a finite resource: a bell-shaped curve of extraction plotted against time, with the maximum possible area under the curve equal to the initial quantity. Time series plots of crude oil production in Ohio and Illinois, he observed, already manifested rise, peak(s) and decline. Based on current recovery methods, Hubbert estimated the ultimate world crude oil reserves (oil which can be removed from known fields with existing technology) at 1,250 Gb. Employing known rates of world production of crude oil and assuming that the maximum production rate would be 2.5 times as high, Hubbert drew a hypothetical bell curve for world population subject to the constraint that the area under it could not exceed 1,250 Gb. This yielded a peak date of about 2000, with th e qualification that "variations of this assumed maximum rate would advance or retard" the peak date. He then applied this method to the 48 continental United States, using two estimates of oil reserves, of 150 and 200 Gb, and drew two bell-shaped "Hubbert curves." The first estimate generated a prediction that U.S. production would peak in 1965; the second famously – and correctly – predicted a 1970 peak.[4]

Hubbert qualified this by noting that reserves were based on existing production techniques, which permitted removal of only a third of the oil. Secondary-recovery techniques were improving though, so in future more oil could be extracted, this increasing reserves. Hubbert thought that this improvement would be too slow to affect the peak date much; more likely, better recovery would slow the production decline beyond the peak. Moreover, the peak and decline of oil output "does not necessarily imply" that industrialized countries will have no liquid or gaseous fuels, "because these can be produced from other fossil fuels which occur in much greater abundance."[5]

Subsequently Hubbert presented new estimates of oil supplies and peak dates. In 1962, using figures for past extraction and oil reserves, he estimated American oil supply at 175 Gb with production peaking in the late 1960s, or 225 Gb and output peaking in 2000. His 1981 estimates put ultimate

Some Estimates of World Oil Supply (Gb) and Predicted Dates of Peak World Oil Production

Source	World Oil Supply	Peak Output Date
Hubbert (1949)	2,000	–
Hubbert (1956)	1,250	2000
Hubbert (1962)	1,250	2000
Hubbert (1981)	2,000	1995
Ivanhoe (1996)		2010
Campbell-Laherrè	1,800	before 2010
Campbell (2000)	1,800	2005
Campbell (2001)	1,950	2010
Deffeyes (2001)	2,120	2003-2009

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world oil supply at 2,000 Gb with output peaking in 1995, or alternatively fixed at 1975 levels, due to Middle Eastern disturbances, until about 2050.[6]

Other geologists have recently applied Hubbert's method to world oil. In 1996, L. F. Ivanhoe pointed out that world oil discovery peaked in 1962, that world production tends to parallel discovery with a roughly 32-year lag, and that most of the world's large oil fields have probably already been found. Using United States Geological Survey (USGS) world data, and allowing for diminished consumption after the 1970s oil price shocks, Ivanhoe put the peak year at 2010, perhaps slightly postponed by discoveries since 1992.[7] Two years later, Colin Campbell and Jean Laherrère, then associated with the Geneva-based Petroconsultants, asserted that "within the next decade, the supply of conventional oil will be unable to keep up with the demand." With forty years' experience apiece in the oil industry, they debunked the industry's optimistic assessment of "proved" reserves exceeding a trillion barrels. Reserve figures are problematic, especially for countries outside America, which can and do inflate reserves for political purposes; shortly after OPEC modified production quotas in the 1980s to take reserves into account, several members increased their reserves by some 300 Gb total. Campbell and Laherrère put total world reserves at 850 Gb, with another 150 Gb still undiscovered. "There is only so much crude oil in the world, and the industry has found about 90 percent of it." Total supply (800 Gb consumed as of end-1997 plus probable reserves plus still undiscovered oil), they concluded was some 1,800 Gb, and output would peak before 2010.[8] Campbell's updated projections obtained similar results; even broadening conventional oil, to include natural gas liquids in oil wells, generated an estimate of 1,950 Gb and a peak in 2010.[9]

"A collision is coming, then, between rising demand and falling annual supply."

Moreover, many specific examples exist of depletion following Hubbert's pattern. A table published by the Association for the Study of Peak Oil & Oil Depletion Analysis Centre (ASPO-ODAC) shows that several oil producers have already peaked, e.g., continental U.S. (1971), Russia (1967), Iran (1973), Venezuela (1970), Nigeria (1979), Libya (1970), Norway (2000), and Britain (1999).[10]

Very usefully, Deffeyes explains basic petroleum geology. Oil exists in layers of "source rock" full of prehistoric organic matter. The source rocks must be, or have been, in the "oil window" – depths between 7,500 and 15,000 feet – because 7,500 feet down, temperatures are sufficiently high, given geologic time, to "crack" sediments containing prehistoric organic matter into oil molecules, but below 15,000 feet, the rocks are so hot that all the oil's carbon-carbon bonds break and oil becomes natural gas. Moreover, the oil must be trapped in porous "reservoir rocks," which must be beneath less permeable "cap rocks," lest the oil seep to the earth's surface and disappear.[11]

Ignorant of petroleum geology, I checked this against some petroleum geology textbooks. Not only is Deffeyes right, geologists have known this for decades – an important point it turns out. John M. Hunt's textbook, *Petroleum Geochemistry and Geology* (1979) discusses the "oil window" in detail, pointing out that "There are limits to the time and temperature (depth) at which petroleum is formed in economic quantities." Moreover, "There is no point in drilling a hole to 20,000 feet ... if the kerogen [prehistoric organic matter] is too immature to generate hydrocarbons or if it so depleted in hydrogen that the generating capability is gone."The oil window is a natural phenomenon caused by kerogen's "thermodynamic instability." Few reservoirs contain oil below 14,000 feet; very few below 20,000 feet. "Deep drilling will not change this picture very much," because the scarcity of oil deeper down is caused by greater temperature, not to too few deep tests.[12]

Only one conclusion is possible: *Hubbert was right.* The supply of conventional oil – and of all hydrocarbons – is fixed and finite. It *can't* increase.

Ominously, demand for this fixed resource has steadily increased. World oil consumption has grown at about 2 percent annually for 30 years. In 1990-2000, world crude oil output rose from 60 million barrels a

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day (mbd), or 21.9 Gb/yr, to almost 70 mbd (25.6 Gb/yr), and is now 75-76 mbd, which comes to about 27 Gb/yr. American consumption rose from 17 mbd (6.2 Gb/yr) to 19.5 mbd (7.1 Gb/yr). America extracts about 6 mbd and imports the rest. Campbell estimates total historical consumption of 873 Gb of conventional oil by end-2001.[13] As immigration bloats Western countries' populations and the Third World industrializes and acquires millions of vehicles, demand will rise.

But as University of Chicago physicist Albert Bartlett's excellent "Forgotten Fundamental of the Energy Crisis" explains, exponential (steady-rate) growth in a finite environment is unsustainable. Steady annual consumption growth of 2 percent implies, taking today's 27 Gb as the base figure, that 267 more Gb of oil will be gone by 2011 – for cumulative consumption of 1,140 Gb, over half the total supply even by optimistic estimates – and that in 35 years annual consumption will double to 54 Gb.

A collision is coming, then, between rising demand and falling annual supply. Conventional oil is *not* running out – roughly half the initial quantity will remain after output peaks – but it *will* be increasingly expensive. Permanently.

Moreover, there are no easy escapes. Exploration and enhanced recovery technologies have already improved greatly, Deffeyes notes, and "there is little expectation" of a dramatic breakthrough. The South China Sea is the only potential province still unexplored. Whereas annual world oil discovery averaged 43.8 Gb in the 1960s, it is down to perhaps 10 Gb now. As of 2000, Campbell observed, we were consuming oil four times as fast as we were finding it. Even if, which is unlikely, more large oil fields are found, Bartlett noted – and his math is irrefutable – that given exponential consumption growth, "a doubling of the remaining resource results in only a small increase" in its life expectancy. Bartlett's recent mathematical analysis of oil production calculated that if the estimated ultimate oil supply were doubled from 2,000 Gb to 4,000, it would only delay the peak 26 years, from 2004 to 2030![14]

Debunking the Cornucopians

All this is devastating for the cornucopian school. Julian Simon argued that natural resources are "not finite in any economic sense," and are infinitely substitutable. Our ultimate resource is human ingenuity. An infinite number of points can fit on a one-inch line segment, "because they have no defined size." Therefore their number is not finite. "Similarly, the quantity of copper that will ever be available to us is not finite, because there is no method (even in principle) of making an appropriate count of it," due to, for example, the possibility of making copper out of other materials. "Hence resources are not 'finite' in any meaningful sense."[15]

This is a farrago of absurdities. Points have no size, but copper and oil molecules do; drawing quantitative parallels between them is nonsense. And just because we cannot definitively measure something, that it is non-finite is a *non sequitur*. I cannot feasiblely count how often the letter "e" appears in the books on my desktop shelves, but the number of books, and their contents, are fixed; therefore "e" necessarily appears in finite quantity. Analogously, since only a finite quantity of source rock is or has been in the oil window, conventional oil must be finite. Making meaningful amounts of one element into another with atom smashers would be fantastically costly.

"Bartlett's recent mathematical analysis of oil production calculated that if the estimated ultimate oil supply were doubled from 2,000 Gb to 4,000, it would only delay the peak 26 years, from 2004 to 2030!"

Simon breezily asserted that "our energy supply is non-finite, and oil is an important example." A given well's productive potential may be measured and limited, but the number of wells that can produce oil, and how much, "is not known or measurable at present and probably never will be."[16] Simon again confuses the indefinite and the infinite. Moreover, by

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now geologists *do* pretty much know where oil is – and isn't – and how much there is.

Even if we could know this global quantity, Simon continued, we would still have to measure the possible oil yield from shale oil and tar sands – and, beyond that, from coal and organic crops (e.g., soybean oils) – and, beyond that, energy from nuclear power, our sun, and possibly still other suns.[17] The supply of oranges is "non finite," then, because we can conceivably convert lemons, apples, watermelons, coconuts and other water balloons into oranges. As if science is magic. Moreover, Simon egregiously telescoped into the present all possible substitutions for conventional oil, from the currently feasible to the remotely possible to the wildly fanciful (apparently with no awareness of the difference), some of which cannot be achieved in relevant quantities for decades or centuries, if at all. *At any given time*, feasible substitution is limited, so is the quantity of substitutes, so is their yield of oil.

Tellingly, Simon's famous books – *The Ultimate Resource* (1981), *The Resourceful Earth* (1985), *The State of Humanity* (1995) – ignored Hubbert. Much of what cornucopians did say about oil is embarrassingly counterfactual. Interviewed by William F. Buckley, Simon asserted that "we in fact grow oil in Illinois," and "copper and oil come out of our minds. That's really where they are."[18] No, Mr. Simon, they're in the ground, and oil doesn't come out of our minds, it comes out of source rocks, and therefore can't be "grown" like wheat.

William Brown's "The Outlook for Future Petroleum Supplies," in *The Resourceful Earth*, asserted that new technologies were "opening up vast new regions with great potential," such as jungles, polar regions, and offshore areas.[19] In fact, worldwide discovery has collapsed.

"Another promising region," Brown added, is deeper depths of existing petroleum areas. "That is, for economic reasons over 95 percent of the existing basins have not been explored below 15,000 feet." Higher prices give incentives to drill deeper, and while it is too soon to say what the potential of deeper deposits is, "[t]here is little doubt that they will be significant. There is a reasonable chance that they will prove to be astonishingly productive" due to new technology. By 2100, Brown believed, almost all petroleum resources up to 40,000 feet down, perhaps deeper, would be explored. Similarly, in 1991 Simon trumpeted that we will "dig deeper and pump faster" and get more oil.[20]

But going deeper would overshoot the "oil window." Drilling stopped at 15,000 feet for geological reasons, not economic ones: going deeper didn't make sense, because deeper down there generally wasn't any oil. Petroleum geologists already knew this. Hunt's textbook, to repeat, appeared in 1979. That Brown, and Simon himself, were so crassly ignorant of well-established facts readily available even in a previously published college textbook is damning. The cornucopians did not know what they were talking about.

"Drilling stopped at 15,000 feet for geological reasons, not economic ones: going deeper didn't make sense, because deeper down there generally wasn't any oil."

Geologists would not have made these howlers, but Brown was Director of Energy and Technological Studies at the Hudson Institute; Simon was an economics professor and Heritage Foundation adjunct scholar. Cornucopians tend to be dwellers in a realm of words, theories, and abstractions – not people in contact with the realities of a limited world. The latter, such as Campbell, Deffeyes, and Ivanhoe, do not parrot Simonesque platitudes. They know better. That the closer one gets to reality and hard science the fewer cornucopians one finds is telling.

In *The Economics of Petroleum Supply*, economist Morris Adelman flatly asserted that "Minerals are essentially inexhaustible. Oil, gas, coal, and copper ... will never be depleted. Investment in exploration and development creates an in-ground inventory of proved reserves, constantly used up and replaced." Adelman's *The Genie Out of the Bottle* proclaimed, "Reserves are renewable and constantly

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renewed, if – and only if – there is enough inducement to invest in creating them. The inducement depends on price and cost." And: "Oil is a renewable resource."[21] Constantly replaced out of what? Renewable how? A higher price gives incentives to find more already-existing oil, but cannot "create" fresh reserves by giving source rocks "inducement" to enter the oil window.

Similarly, USGS geologist Peter McCabe analogized oil reserves to a grocery warehouse "constantly being replenished with baked beans from canned food manufacturers."[22] Food canneries exist; oil factories do not. Where do the new reserves ("baked beans") keep coming from, if, as McCabe admitted (see below), fossil fuels are finite? An Easter Egg hunt is a better analogy; as the kids search longer, harder, and smarter, they find more eggs – but they can't find more than Mom's basket held to start with.

Adelman and Michael Lynch argued that seeing resources as fixed is unduly pessimistic. Estimates of falling reserves and production "are incurably wrong because they treat as a quantity what is really a dynamic process driven by growing knowledge." Knowing the limit to oil reserves and output requires knowing future science and technology, which is impossible.[23] Simonesque confusion of indefinite and infinite. And the facts of oil formation necessarily mean a ceiling on discovery.

Other cornucopians, such as Robert Bradley, president of the Institute for Energy Research (and Enron's Director of Public Policy Analysis) regurgitate earlier optimism, assert abundance, and ignore contrary evidence. Bradley's "The Increasing Sustainability of Conventional Energy," written for the Cato Institute, a leading libertarian think tank, cites Adelman and Lynch, invokes "human ingenuity," and asserts that the 1992-1996 period's 40 percent drop in costs for finding oil in America "is perhaps the best indicator that oil is growing more abundant, not scarcer."[24] This *non sequitur* (cost may be dropping because exploratory technology is getting more powerful) cannot be squared with the well-known collapse of American oil discovery, which Bradley ignores.

A hint that cornucopians inhabit an alternative wish-based reality is their citation of physicist Thomas Golds' theory of a "deep, hot biosphere" in which oil is produced, from which it rises, implying abundant undiscovered oil.[25] If this is so, why has world oil discovery collapsed since the 1960s? More to the point, will new oil from the "deep, hot biosphere" arrive quickly and abundantly enough to avert a painful crisis? Oil which won't be accessible for another thousand years *does not exist* for all practical purposes.

Flawed Cornucopian Attacks on Hubbert

When cornucopians do engage Hubbert, they often misrepresent him or raise false issues. Witness the following examples.

Trying to make Hubbert look gloomy, Adelman and Lynch cite him selectively. They present his 1974 estimate of the U.S. oil supply of 170Gb – then note that as of 1997 production was already 170 Gb, with proved reserves of another 20 million barrels, with 2 Gb added annually, and that the USGS's current estimate was 250 Gb. But his prediction of the 1970 peak assumed a 200 Gb supply, which they ignore. Likewise, they present only his 1,250 Gb estimate of world supply and cite the USGS estimate of 2,400 Gb – ignoring Hubbert's other estimates of 2,000 Gb.[26] This is too dishonest to take seriously.

McCabe characterizes Hubbert as believing that "resources are finite," as if this is a defect – but admitted that "in the long run the supply of fossil fuel is finite," and "The amount of fossil fuel ... of course, is finite." He misrepresents Hubbert as "regard[ing] Ohio's oil resources as virtually exhausted," when his 1956 paper said no such thing.[27]

Cornucopians belabor the bell-shaped curve. "There is no inherent reason" why a given fossil fuel's production plot "should have a symmetrical bell-shaped curve," McCabe intones. The University of Oklahoma's David Deming adds that "there is no unique Hubbert curve," but that Hubbert himself apparently exclusively used symmetrical curves.[28] Much ado about nothing, since, as these writers admit, Hubbert said production plots could have more than one maximum and an infinity of possible shapes. Worse, this is a red herring, conveying an impression that Hubbert stands or falls on production plots following a bell-shaped curve. Hubbert's essential points were that a fossil fuel's supply is fixed and finite, therefore exponential growth in extraction is

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unsustainable, extraction must eventually decline and cease, and total extraction cannot exceed initial quantity. The curve's shape is unimportant.

Deming claims that Hubbert's 1956 paper "made what he considered to be a 'best' estimate" of total U.S. crude oil supply – 150 Gb. As for predicted peak dates, "The actual peak occurred in 1970. Hubbert's best estimate (1956) of peak production in 1965 was in error by five years, with the actual production peak occurring at the outer limit of his uncertainty range." The claim of Hubbert's adherents that he was right "is only true if Hubbert's (1956) upper curve ... is used, and Hubbert's actual prediction of 1965 is ignored."[29] This is flat dishonesty. I have read Hubbert's paper, and nowhere did he describe the 150 Gb estimate as his "best," or call 1965 his "actual" prediction or "best estimate," or give it more weight than 1970.

Deming notes that Hubbert "was intimately involved with technocracy," which envisioned a "highly authoritarian" ideal society, and that authoritarian governments – Nazi Germany, the Soviet Union, Communist China – were mass murderers. Hubbert's politics "appear to have been dangerously wrong." Deming wonders if they "may have influenced his scientific conclusions" regarding oil.[30] A shameful smear by association.

The Chimera of Alternatives

But the cornucopian trump card is that we can substitute unconventional hydrocarbons (shale oil, heavy oil, tar sands, etc.) for conventional oil if oil price increases make it economically viable. We could even extract carbon and hydrogen from the air and fabricate hydrocarbons. "The only realistic limitation ... is price," argues Maurice Dessault of the University of Waterloo in Ontario.[31]

Uncannily, like the shipwrecked economist assuming a can opener in order to open the can of food, cornucopians assume that technology will make this feasible. This is just Micawber-like profession of faith: something will turn up. What if it doesn't?

More importantly, the price argument overlooks the physics. Processing unconventionals is energy-costly. If processing consumes more energy than it yields, it is a loser; price is relevant.

Shale oil could yield trillions of barrels. But extraction is forbiddingly tough. Oil shale is kerogen-containing rock – source rock which has not been in the oil window. It requires not only mining, but processing: replicating, in telescoped time, what happens in the oil window, by crushing the rock and heating it to 900 degrees Fahrenheit, liquefying the kerogen – which must be processed into oil by adding hydrogen, then refined. Resultant waste requires disposal. Net energy yield is at best slightly positive. "It is doubtful that shale oil can ever play a significant role in replacing world oil supplies, if it can replace them at all," geologist Walter Youngquist concludes. "Shale oil cannot possibly make the United States energy self-sufficient in terms of liquid fuel."[32]

Extracting heavy oil requires heat (often steam or hot water) and solvents. On average, one oil barrel's worth of energy must be expended to get two barrels of heavy oil. Extracting oil from tar sands is underway in Canada, but requires much heat, currently supplied by natural gas, an average of one thousand cubic feet of gas required per barrel of tar sand oil.[33] With present extraction technologies, these alternatives are not promising.

Heavy oil deposits along Venezuela's Orinoco river have been processed into an oil-water emulsion ("orimulsion") for powering electric generating plants. New methods are in use to extract the heavy oil and refine it into crude, and from crude into fuels. Canadian tar sands now yield 250,000 barrels as day, expected to double by 2007. Over 200,000 barrels flow daily from the Orinoco; this is expected to triple by 2006. "Gas-to-liquids" conversion of natural gas to liquid fuels may yield a million barrels by 2020. Campbell estimates that combined Canadian and Venezuelan output of tar sands and heavy oil will be 2.8 mbd in 2005, 3.6 mbd in 20120, and 4.6 mbd in 2020 – or 1.0, 1.3, and 1.7 Gb/yr, respectively.[34] These are drops in the bucket, given today's consumption of 75 mbd, and higher demands in the future. Absent crash programs to boost output, and technological breakthroughs, these sources will not help much.

As for making ethanol from corn, after examining the process and factoring in all its energy costs, including those entailed by growing corn, Cornell University agricultural science professor David Pimentel concluded that a gallon of corn-based ethanol costs about 71 percent more energy than it contains, making ethanol a loser.[35] Ethanol partisans, including the National Corn Growers Association,

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retort that Pimentel recycles old data and ignores recent technical progress.[36] But even if he is too pessimistic, significantly replacing oil with ethanol would require colossal expansion of corn cultivation, massively depleting water and topsoil, and competing with other land use, such as housing our immigration-swollen population.

Natural gas is abundant, and can partly substitute for oil. But natural gas too is finite, and its output too will eventually peak and decline; Campbell and Laherrère project world output peaking in 2020.[27]

Wind, nuclear, and solar power cannot replace oil as input for petrochemicals – plastics, pharmaceuticals, tires, asphalt, fertilizers, etc. They are only limited energy substitutes: aircraft, trains, tractor-trailer rigs, farm machinery, and construction equipment cannot use wind, nukes, solar panels, or batteries. Many vehicles and other machines integral to our way of life simply must have liquid fuel.

The claim that a price will solve any problem or remove any shortage if it simply gets high enough reflects two related, fundamental impieties in modern man: that human ingenuity can escape the limits of the human condition and of reality, and that demand creates supply. In short, *you can get your way if you want it badly enough*. Clap your hands, and your servant Reality will come running. This is what makes Julian Simon's glib, fatuous blather so dangerous. One of the most pernicious manifestations of man's perennial rebellion against creaturehood, the cornucopian school tells impious modern man what he most wants to hear: limits do not exist, you can get something for nothing, desires trump reality, don't worry, be happy.

But man is not God and reality cannot, will not, infinitely accommodate him, never mind price or blustering about human ingenuity. If rocks contain no oil, *they will yield no oil;* if an aquifer is drained, *it will yield no water;* if processing an alternative source takes more energy than it yields, *it is senseless* – no matter how high prices get. Prices convey information. They do not work magic. In anything grounded in physical reality, science, not economics, has the last word.

Clearly, the cornucopian school is an intellectual opium den. There are limits on human possibilities, and we are about to collide with them.

Connecting the Dots: The Grim Consequences

This collision will be painful. All economic activity requires energy, and roughly 40 percent of the world's primary energy demand is met by oil.[38] Petroleum underlies just about everything we do. No other energy source can match conventional oil for versatility, portability, ease of storage, net energy yield, and so on. Cheap conventional oil is one of the primary factors making our affluent, comfortable modern way of life possible. It follows that when oil is no longer cheap, our way of life will be disrupted to the point of unsustainability.

The drying-up of cheap conventional oil will do for the modern economy what a long drought does for agriculture. One obvious consequence will be a persistent replication of the "stagflation" – simultaneous inflation and recession – which followed the 1973-1974 oil embargo. Real wages and labor productivity will stagnate or even decline. Since producing and transporting all production inputs takes energy, much of it fossil fuel, costlier oil will make them costlier too, meaning that an investment dollar will not buy as much productivity growth as it could before.

Meanwhile, by a gruesome coincidence, right around the time oil peaks, the Baby Boomers will start flooding Social Security and Medicare beneficiary rolls. So just as the largest generation in American history begins retiring (the oldest Boomers will be 65 in 2010), the cheap oil bottom will start dropping out of the economy which will have to support them. The inflationary recession largely caused by the 1973-1974 oil crisis precipitated the first financial crisis in Social Security's history, as higher-than-anticipated inflation drove inflation-adjusted benefit outlays up and unemployment shrank Social Security's tax base. This time the oil shock will be permanent.

The Congressional Budget Office projects that spending for Social Security, Medicare, and Medicaid, which provide old-age and elderly health care benefits, will rise from 7.8 percent of GDP in 2001 to 14.7 percent by 2030. Assuming federal revenues remain roughly 20 percent of GDP, and entitlement programs are unchanged, the General Accounting Office forecasts that by 2030 federal outlays will be roughly 28 percent of GDP and Social Security, Medicare,

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Medicaid and interest on the debt will take 75 percent of revenues. By 2050, outlays will be almost 40 percent of GDP, and revenues will cover only half of them, making the budget deficit some 20 percent of GDP.[39]

These frightening calculations reflect only an aging population, and ignore cheap oil's demise. Moreover, *all* forecasts by Social Security's and Medicare's actuaries, *including* the pessimistic ones, assume steady long-term growth in real wages, productivity, and GDP. Obviously, an economy crippled by higher inflation, soaring energy costs, rising unemployment, and stagnant productivity cannot carry these burdens. The oil crunch, then, will disastrously worsen the coming fiscal crisis of entitlements. It therefore greatly strengthens the case for rigorous means testing to cut entitlement costs. It also kills Social Security privatization, a severe, prolonged bear market in stocks being a likely consequence of a persistent and worsening energy squeeze.

The effects will be grimmest in agriculture. As cornucopians always brag, modern agriculture is fantastically more productive than traditional farming. What they overlook is that it gives hostages to hydrocarbons. As Bartlett aptly put it, "Modern agriculture is the use of land to convert petroleum into food." In 1999, according to the U.S. Department of Agriculture's Economic Research Service, energy costs accounted for 24-31 percent of the total variable cost for field crops (e.g., corn, wheat). Not only does modern agriculture use fossil fuels for machinery, transportation, groundwater pumping and irrigation, it depends heavily on fertilizers, which are made by reacting natural gas with nitrogen. Since natural gas accounts for 75-90 percent of the cost of nitrogen fertilizers, rising natural gas prices will devastate the fertilizer industry; fertilizer producers could not cover costs by the end of 2000 due to high gas prices.[40]

With natural gas substituting for oil, demand will be increasing for a supply which will be falling after about 2020. This means steadily rising gas, fertilizer, and food prices, and dwindling crop yields in nations which must import natural gas, fuels and fertilizers, and which cannot afford the squeeze. North Korea's recent famine is a warning of modern petroleum-based agriculture's vulnerability to breakdown if hydrocarbon inputs disappear; when fuel and fertilizer supplies collapsed, so did agriculture; three million North Koreans starved to death.[41]

Moreover, costlier energy will exacerbate our already-worsening water problems by making it costlier to purify and recycle contaminated water and to drill for, pump, and transport ground water.

The coming oil crunch makes curtailment of mass immigration an urgent imperative. Mass migration from Third World countries with low per-capita energy use to affluent nations with high per-capita energy use must necessarily increase total energy demand. Surging immigration, the main contributor to America's population growth, will greatly increase demand for costlier energy. In 1973-1995, American energy consumption rose some 22 percent, some roughly 90 percent of it due to population growth.[42] It is well known that immigration accounts for some 70 percent of population growth since the Seventies. This means immigration accounts for the lion's share of the increase in energy use – roughly 63 percent (.9 x .7 = .63). It necessarily follows that we cannot tackle energy without tackling immigration. This is not nativism, this is arithmetic.

California's energy crisis is grimly instructive as to what continued mass immigration means. As Ric Oberlink observed, California's total energy consumption more than doubled in 1969-1999, even though per-capita use grew only 22.9 percent (from 5,655 kilowatt-hours to 6,952). The reason? California's population rose from 19.7 million to 33.1 million (up 68 percent), some 95 percent of it due to immigration.[43]

Not only will mass immigration worsen the oil problem, most immigrants have no human capital to offer to help cope with it. In fact, immigration will make coping disastrously harder. Floods of immigrant labor will exacerbate productivity and wage stagnation, thereby worsening economic stagnation, making it harder to afford costlier energy, goods, services, and entitlements – and harder to finance the urgently needed huge investments in alternative energy sources, meaning our energy plight will worsen. Should hydrocarbon inputs for agriculture decline, yields on already-heavily worked croplands, depleted of natural nutrients, will fall, forcing us to bring more land under cultivation – which will collide

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with the urban sprawl due to immigration-driven population growth. Mass immigration and the decline of conventional oil, then, will create a vicious circle, each one worsening the problems spawned by the other.

Colin Campbell warns that America "has to somehow find a way to cut its demand [for oil] by at least five percent a year."[44] This will be impossible without a complete moratorium on immigration, for at least two decades, to see us through the transition from cheap oil to a sustainable mix of substitutes. We cannot simultaneously cut demand for oil while allowing the main force driving it higher to keep operating. The longer mass immigration continues, the more per capita energy use must fall to compensate – meaning the more austere and impoverished our lives must become. Put another way, continued mass immigration in a context of declining conventional oil output will rapidly turn America into an impoverished nation with Third World living standards.

Obviously, we must promptly develop alternatives to conventional oil and natural gas. But equally obviously, we must take measures promptly to conserve energy. And an immigration moratorium is at the top of the list. ■

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Best English language site. Arguing from a Hubbert perspective, it includes news, editorials, information on natural gas and alternative sources, information on Hubbert and his theory, some key works by Hubbert, and articles, reviews, and analyses by experts such as Professor Albert A. Bartlett, Colin J. Campbell, L. F. "Buss" Ivanhoe, Deffeyes, Jean Laherrère, and Walter Youngquist. Clicking "Ivanhoe" accesses the M. King Hubbert Center for Petroleum Studies, a unit of the Colorado School of Mines, which Ivanhoe coordinates. This gives access to the complete set of issues of the concise but highly informative Hubbert Center Newsletter, published quarterly since 1996.

hubbert.mines.edu

This is the internet address for the Hubbert Center, in case you want to go there directly rather than through oilcrisis.com.

Www.isv.uu.se

Detailed coverage of May 2002 International Workshop on Oil Depletion, Uppsala University, Uppsala Sweden, and beginning with the January 2002 issue, the excellent newsletter of the Association for the Study of Peak Oil & the Oil Depletion Analysis Centre, edited by Colin J. Campbell (co-author of "The End of Cheap Oil").

www.energiekrise.de

A German site which makes its materials available in both German and English. (To convert German language materials to English, click "English" on the bar at the top of the home page).

www.runningonempty.org

This is a useful survey of the situation with basic facts, figures.

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Watch for Water Wars

by William B. Dickinson

In the summer of 1900, drought ravaged the corn and wheat fields in western Kansas, and along with them my grandmother's dream of a college education. No money was to be had for her return to the University of Kansas. Crop failures were common events in the plains, whether from drought, hail, heat or bitter cold. But in the day before grower subsidies, "deficiency" payments and emergency farm aid, families lived from crop to crop. She was forced to leave home for Utah and a job teaching in a one-room schoolhouse.

This personal history occupies my thoughts as I read of a drought in the High Plains described as the most devastating in more than a century. A swath of the American midsection that includes much of eastern Montana, Wyoming and Colorado, plus parts of western Kansas, is under siege. Some places have had less than an inch of rain in nearly a year. Blinding dust storms are reported, with the soil dry down to two feet in some areas. "In eastern Montana," reports the *New York Times*, "more than a thousand wheat farmers have called it quits rather than try to coax another crop out of the ground that has received less rain over the last 12 months than many deserts get in a year."

Not that folks here in Kansas need to be reminded of Nature's fickleness. The first of many droughts in Kansas came in 1860, when for 16 months prairie farmers subsisted without a single measurable rainfall. A merciless sun and hot gusty winds beat down upon the parched landscape. Even the hardy prairie grasses succumbed. Springs, streams and wells dried up. In *Pioneer Women*, Joanna L. Stratton captures the calamity: "Distressed at the condition of their hungry children, pioneer mothers scoured the countryside for wild berries, acorns, nuts and grasses, while their husbands set off on distant hunting expeditions." In that one year alone, more than 30,000 people fled Kansas, reducing its population by 30 percent.

Now, with the High Plains beginning to blow away, memories of the Dust Bowl era of the 1930s are reviving. In the desolate Depression-era winter of 1933-34, New Dealer Rexford Tugwell traveled across the Great Plains on a fact-finding mission and sent back frightening word to Washington. The parched soil, he said, showed through the grass, and the wheat was thin – "like the stubble on an old man's chin." Historian Arthur W. Schlesinger, Jr. evokes the terror and despair of the drought, which lasted until 1936:

> *Dust drifted like snow against barns and fences. Schools were closed, cars stalled by the side of the road, street lights shone at noonday ... On and on the clouds whirled, some into the astonished East, spreading their baleful orange and amber aura, the smell of dirt and the taste of grit, until they passed on and fell at last into the Atlantic.*

Drought in the Third World

Those of us who are heirs to this state's history have considerable respect for the vagaries of nature. So it is with apprehension that I read about deteriorating water supplies – rivers running dry, aquifers depleted – in crowded parts of the world. Unlike my forebears, who could retreat east to Iowa and Missouri in dry years, most of the world's poor are trapped in environments that allow little room for natural disasters. Urbanization has thrown hundreds of millions on the mercy of municipal water supplies that are

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inadequate and polluted

Southern Africa, already one of the world's poorest regions, faces its worst food shortage in a decade after erratic weather marked by alternating periods of flooding and drought destroyed crops. Malawi, Zambia, Zimbabwe, Mozambique and Swaziland find themselves in dire straits or will be soon according to the United Nations World Food Program. An official who toured the area reported that she found schools where as many as half the students were kept home to forage for food. Rapid desertification in China and a prolonged drought striking that country and other parts of Northeast Asia this spring led to a "season of yellow dust." School was called off in Seoul, South Korea, in early April when an immense cloud of dust blew in from China's fast-spreading deserts 750 miles away.

Chinese officials report that the Gobi Desert grew by 20,000 square miles from 1994 to 1999. Its implacable advancing edge now sits a mere 150 miles north of Beijing. Of China's 617 largest cities, 300 already are facing water shortages. In just 32 years, China will need perhaps three times as much water to satisfy its demand, according to *WorldWatch* magazine. Lest you think this is a far-away problem, consider this: Fingerlike plumes of China's sand now travel 7,000 miles aboard the jet stream to create spectacular sunsets in Portland, Oregon, and San Francisco. Warning flags should be flying.

In Latin America, the flight of peasants to cities has created shortages of fresh waters. In Bolivia, people protesting privatization of municipal water battled police and soldiers in the Andean city of Cochabamba in what has been called *le guerra del agua* – the Water War. In a "Letter from Bolivia" published in *The New Yorker* (April 8), William Finnegan wrote that opponents of privatization "believe that access to clean water is a human right" and added: "The world is running out of fresh water. There's water everywhere, of course, but less than 3 percent of it is fresh, and most of that is locked up in polar ice caps and glaciers, unrecoverable for practical purposes ... Water demand ... has been growing rapidly ... it tripled worldwide between 1950 and 1990 ... and water use in many areas already exceeds nature's ability to recharge supplies. By 2025, the demand for water around the world is expected to exceed supply by 56 percent.

If world population increases as projected – nearly 3 billion more people by 2050 added to today's 6.1 billion – water disputes are inevitable. The U.S. Central Intelligence Agency recently expanded its monitoring of conflicts and threats to include environmental issues. In a report entitled "Global Trends 2015," it said that the possibility of conflict would increase as countries press against the limits of available water between now and 2015. Nearly one-half of the world's land consists of river basins shared by more than one country, and 30 nations receive their water from outside their borders.

"Turkey is building new dams and irrigation projects on the Tigris and Euphrates rivers, which will affect water flows into Syria and Iraq, two countries that will experience considerable population growth," the CIA report said. "Egypt is proceeding with a major diversion of water from the Nile, which flows from Ethiopia and Sudan, both of which will want to draw more water from the Nile for their own development by 2015. Water-sharing arrangements are likely to become more contentious. Water shortages occurring in combination with other sources of tension – such as the Middle East – will be most worrisome."

That may be an understatement. If one is to believe a United Nations report released on World Water Day (March 22), some 2.7 billion people will face a critical shortage of drinkable water by 2025. Don't count on these people to accept the shortages with fatalism. Edward O. Wilson writes in his new book, *The Future of Life*: "As the populations continue to explode [in developing countries] and water and arable land grow scarcer, the industrial countries will feel their pressure in the form of many more desperate immigrants and the risk of spreading international terrorism." While the West concentrates on an Axis of Evil, millions of Third-World families have an equally urgent fear: There's not a sip of cool, clean water anywhere on the burning sands. ■

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Reflections of an INS Special Agent

by Mike Cutler

A milestone in our nation's efforts to enforce and administer the immigration laws of our country was reached on April 25, 2002. The House of Representatives passed a bill that would abolish the Immigration and Naturalization Service (INS) and create two new agencies to take its place. These new agencies would rise up, like the mythical Phoenix, from the ashes of the INS. It is hoped that these two new agencies will possess the leadership, support and commitment to conduct the business of enforcing and administering the immigration statutes in a far more efficient and effective fashion than did the old INS. This dream of creating new agencies has been around for quite some time. That the INS has failed to do what it was being paid to do has not been a secret. The INS has been a disaster for decades but nothing of substantive value was done to truly bring about the needed reform. Sadly, the catalyst that finally sounded the death knell for this agency was the terrorist attacks of September 11 and the further public demonstration of incompetence and ineptitude of the agency. This incompetence was demonstrated in a very public and embarrassing way, when two of the dead terrorists were sent letters from the INS notifying them that they had been approved to attend flight school in the United States six months after they carried out their deadly attack on our country!

On September 11, over 3,000 innocent people lost their lives in a horrific instant. Certainly the nature of the attack and the brutality in which those lives were snuffed out served notice to us that we are vulnerable. However, we should have realized how vulnerable we have been for decades when you consider that this was not the first time that our country was attacked by terrorists. Additionally, our nation has been victimized by many criminal aliens from all over the world. I want to make it clear: I believe that only a small proportion of the aliens in our country are involved in serious criminal activities, however, a significant proportion of our criminal population is comprised of aliens.

Until February of this year I was employed by the Immigration and Naturalization Service as a Senior Special Agent assigned to the New York District Office's Organized Crime, Drug Enforcement Task Force (OCDETF). I began my career with the INS in October, 1971, as an Immigration Inspector assigned to John F. Kennedy International Airport. I spent four years as an inspector, and for one of those years, 1974, I was detailed to the I-130 Examinations Unit at the New York Office of the INS. This unit was given that name because of the I-130 Petitions that the examiners in that unit adjudicated. The I-130 Petition is an application that a family member who is either a United States citizen or a resident alien files on behalf of an alien relative whom they wish to have reside permanently as a Lawfully Admitted, Permanent Resident Alien (LPR). My assignment required that I conduct interviews with aliens and their spouses who had filed petitions in their behalf to attempt to determine if the aliens and their spouses were truly married and living together, or were engaged in committing marriage fraud in an attempt to circumvent the immigration laws.

In August, 1975, I became a Criminal Investigator with the INS (this position was ultimately renamed Special Agent). As a Special Agent, I rotated through virtually every section within the Investigations Branch. In 1988, I was assigned to represent the INS at the Unified Intelligence Division (UID) of the New York Office of the Drug Enforcement Administration. I spent nearly four years in this assignment working with representatives from a wide array of other law enforcement organizations. It was during this

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assignment that I commissioned a study of DEA arrest records in an effort to identify the involvement of aliens in narcotics trafficking and related crimes. I determined that roughly 60 percent of the individuals arrested by the DEA in the New York area were identified as being foreign born, while nationwide approximately 30 percent were identified as foreign born. Can you imagine the impact that all of these narcotics traffickers have had on our nation and our people? How many people were directly or indirectly killed because of the activities of these drug traffickers? What has the impact been on the quality of life of those whose families have been affected by the narcotics addicts who are part of their families and by the crimes that the addicts commit? How much money has our country lost as a result of these issues?

We need to also consider the impact of other criminals who have come to the United States to ply their trades as criminals. Think of all of the various ethnic organized crime groups which have come to America because they still see our nation as the "Land of Opportunity." We have attracted criminals from virtually every corner of the globe, ranging from members of Russian organized crime to Jamaican gang members to the Chinese triads. These criminals often prey on people who come from the same country they originate from. Can you imagine the impact that this has? People lawfully come to the United States to share the "American Dream" only to find that the criminals who made their lives miserable in their home countries have come here to continue to torment and victimize them. When these criminals find few obstacles to preying on their compatriots, they often move on to victimize everyone they can in our country. The INS is in a unique position to help lead the charge against these predators, yet with fewer than 2,000 Special Agents and a growing list of responsibilities being thrust upon them, who will do the job?

The INS has consistently failed to live up to its potential. When I first began to work for the INS, the perception was that most of the aliens who were illegally in the United States were simply coming here to work and send money home. All too many people felt a certain empathy with those who would come here to seek their fortune because, after all, we are a country of immigrants. We all read Emma Lazarus' famous words, "Give me your tired, your poor, your huddled masses yearning to breathe free..." INS was seen as that nasty organization which sought to handcuff all of those huddled masses. We are, after all, a generous country, populated by compassionate citizens. We are also a nation which has had a voracious appetite for the cheap and compliant labor furnished by illegal aliens, which is needed by factories and farms to turn out the products and food that we all count on.

In the 1970s I was assigned to a squad known as ACIS (Area Control Illegal Status). This section of the Investigations Branch was responsible for arresting as many illegal aliens as possible. To many of us who were assigned to this unit it became apparent that the easiest way to arrest the most number of aliens in the least amount of time was to arrest women who worked in so-called "sweat shops." If they had minor children who were also illegally in the United States, we could also "scratch" the children (process them) and thereby take credit for not only the mother, but her young children as well. If you arrested a woman who had three children, you could take credit on paper for arresting four people, no matter that the children were all under the age of ten. Many agents found this way of carrying out their duties enhanced their productivity by enabling them to turn in as many arrests as possible. My partners and I, however, tended to buck the system and sought to spend most of our time arresting alien criminals who were involved in serious criminal activities. Please don't misunderstand – I believe that anyone who is in the United States in violation of our laws should never feel complacent about their illegal status, it was just that with the limited resources that the INS had, I believed then, as I do now, that law enforcement must operate on the principle of a triage, you must address the most serious problems before you can address the less serious problems. In an ideal world, no illegal alien should reside in our country.

When I participated on raids on factories, I often found myself being yelled at not only by the owner of the factory we raided, but often by the owner of the competitor's factory, deriding me for arresting the illegal aliens. The INS has been locked into an untenable situation. It is believed that the "magnet" which draws most illegal aliens to the United States is the prospect of getting a job so that they can make far

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more money than they could even dream of earning in their home countries. The theory is that if you are able to prevent illegal aliens from being gainfully employed in the United States, you will take from them the incentive for coming to the United States in the first place. The problem with this is that there are so many illegal aliens and so few Special Agents. At present, it is believed that there are as many as eight million illegal aliens living in the United States. We have gotten to the point where we are simply overwhelmed by the sheer number of aliens who are currently living and working in our country in violation of immigration laws. As I noted previously, at present there are fewer than 2,000 Special Agents of the INS to enforce the immigration laws within the interior of the United States who are being given a growing list of missions they need to carry out.

During the time that I was assigned to the Area Control squad, I worked closely with the members of the New York City Police Department (NYPD) in going after aliens who were engaged in such crimes as weapons possession, robbery, rape, murder, and drug trafficking. I remember one operation that I conducted in conjunction with members of the NYPD involving the anti-crime plain clothes officers assigned to the 71st Precinct in Brooklyn many years ago. I worked out a plan with the police officers in which the INS would furnish about ten agents and the police officers would come up with a sufficient number to carry out the plan.

There was a block on Union Street that had many abandoned buildings. The drug dealers in the area would duck into the abandoned buildings and run up to the roof tops if they thought that the police were coming down the block. The plan was relatively simple. I would lead my colleagues and a number of plain-clothes police officers down the block in small numbers and we would gradually infiltrate the block, climbing up the abandoned buildings to the rooftops. We waited a couple of hours to give the drug dealers time to forget that we had been there. From our vantage point on the rooftops, we waited for the drug activities to pick up on the street below. When business was "booming" I grabbed the NYPD walkie-talkie and told the uniformed police to close in. They raced down the block and the drug dealers raced up the stairs or fire escapes depending on whether or not the interior staircases were intact. They raced all the way up to the rooftops, in some cases, leaping from one building to another. To their great disappointment, they found us waiting for them. By the time the operation was over, we had arrested nearly twenty drug dealers, most of whom were aliens. Two of the individuals, as I recall, were fugitives who were wanted for murder. Several of them were aliens who had been previously deported. We seized several handguns and a quantity of narcotics. No one was hurt and all went smoothly and many of my bosses were happy with the operation, until my bosses notified INS headquarters about the operation. There is a saying that, "No good deed goes unpunished." Nowhere is that expression more relevant than at the INS! We were ordered to never do anything like that again. Purportedly HQ thought that the risk that something could have gone wrong was more important than the success we scored that day.

The not surprisingly cynical INS Special Agents often say that INS management wants us to make an omelet without breaking the eggs. Certainly it is important to minimize risks. However, minimizing risks is one thing, obstructing your people and keeping them from doing an effective job is something quite different.

In order to be a deterrent, a law enforcement organization has to be successful in carrying out its responsibilities. If you fail to do an effective job, you fail to deter crime. The INS has long failed to deter the crime that the agency is supposed to combat, because it doesn't have the manpower for its interior enforcement program, and also because this beleaguered agency has failed to take a strong role in going out and getting the job done. If the Immigration and Naturalization Service served as a deterrent, it did so to its own employees who wanted to do a good job.

Creating a pair of new agencies would go a long way to solving the problems that the old INS had in getting its often conflicting missions accomplished. It is difficult to work for an agency that refuses to support the hard work of its agents. When you work for an agency in which the person at the top of the chain of command in your office is responsible for both providing benefits to aliens as well as seeking to arrest, deport and/or prosecute aliens for violations of laws, the goals often become muddled and confused.

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In years past, Special Agents were detailed to the Examinations (benefits) side of the operation to supplement the examiners in clearing up voluminous backlogs. Try to imagine what a "head trip" this is. On one day you are supposed to go out and arrest aliens who are in violation of law in the United States, and the next day, you are supposed to come into the office and process aliens, sometimes someone you may have previously arrested, and help to give them a benefit such as political asylum or employment authorization. Talk about an identity conflict!

The best hope that we have to make certain that the immigration laws will be more effectively enforced is to create these two new agencies, provided that we can effect meaningful changes in management. Poor management has been, in my experience, one of the greatest hurdles that the field agents have had to overcome in order to do an effective job.

The fact that the House of Representatives has voted overwhelmingly to abolish the INS and create two new agencies in its place should encourage us. Hopefully, that which has passed as "business as usual" will no longer be what we have consistently seen. I hope that the Senate will show similar courage and pass comparable legislation which will lead to the creation of a truly effective law enforcement agency, thereby becoming a true deterrent to those who would violate our nation's immigration laws. ■

Belief As a Badge of Belonging

by Katharine Betts

Serious conflict in Australia has shifted from economic questions to cultural questions, and attitudes to multiculturalism provide a useful example of this. But behind the shift is a broader change: the growth during the past 30 years of a new class of upwardly mobile men and women, highly educated and doing well in the professions. If we can bring them into focus, we can analyze the conflict.

One sector of society derides the new professionals as a chardonnay-drinking, chattering class, while another is appalled at the growth of anti-intellectualism. In the former we seem to have Tony Abbott, the Prime Minister, *Quadrant* magazine and many respondents to opinion polls, and in the latter inner-city dwellers, anguished contributors to the broadsheet press and many academics.

Attitudes to structural multiculturalism – the celebration of cultural differences plus policies designed to preserve these differences – are one battleground. Multiculturalism of this type is unpopular with most Australians but, curiously enough, more popular with university graduates than it is even with migrants.

In 1994, an Irving Saulwick poll asked people to choose between two statements: "We should welcome and respect migrants who have different ways of living and behaving" or "Migrants should learn to live and behave like the majority of Australians do." Overall, 35 percent chose the first statement and 61 percent the second. But 58 percent of graduates chose the first one, compared with only 39 percent of migrants. How can we explain this?

Our ideas about the world shape what we think and how we behave. But they also double as social markers that say something about the people who profess them.

Tradition, the conventional family, social cohesion, assimilation, border control and patriotism – are these ideas close to your heart and do you tell people about them? If so, you are

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not just developing a point of view. You are also saying something about yourself, providing clues that will allow others to label you as friend or foe and to slot you into a mental hierarchy: someone who is one of us and a good type or someone who is one of them and an inferior, not-so-good type.

But what if you advocate racial diversity, multiculturalism, minority rights, the welcome mat for boatpeople and internationalism? On the lips of a new-class speaker, these ideas say: "I am a tolerant, enlightened, sophisticated person." The corollary is easily added: All tolerant, enlightened sophisticates think like this; if you don't agree, don't try to join this club."

People who hold the first set of ideas are nationalistic, less articulate and in the majority; cosmopolitans who hold the second set might win the verbal battles but they lag in the polls. The cultural divide is illustrated by differing attitudes to history: the 1999 Australian election survey found that only 32 percent of graduates were "very proud" of Australia's history compared with 41 percent of non-graduates. It also helps explain the blue-collar vote for the Coalition.

Multiculturalism has been a leading notion in Australia's cultural battles and, although some multicultural enthusiasts are "trendies," keen to prove their new-class credentials, many are sincere – some passionately so. But sincerity does not prevent support for multiculturalism from functioning as a status symbol, a badge of belonging for new-class professionals.

What does the conflict look like from the other side? Snobbery, hypocrisy and self-righteousness. Affluent supporters of multiculturalism can insulate themselves from its costs, enjoy its benefits and go on to make a virtue of their privileges – and they can do this while sneering at their fellow citizens who do not enjoy their advantages.

Although there are lots of ideas that operate solely on their own terms, many have this dual function. The problem with multiculturalism is not that it divides believers from unbelievers – Marxism, creationism, homeopathy, and economic rationalism do this, too. The problem is that the marker function of multiculturalism became so strong in the Hawke-Keating years that it came to outweigh the content of the idea.

Once the social-marker aspect of an idea becomes more significant than its content, questioning that content is difficult. During the heyday of multiculturalism, any skeptics within the new class had to choose their words carefully; they knew how easily they could be tipped over the line separating the cognoscenti from the rednecks.

For critics on the outside, the situation was worse. They didn't know the pitfalls or, if they did, resented having to play by rules set by the other side. So new-class experts found it easy to portray such critics as uneducated and prejudiced – uncouth individuals displaying the unpleasant symptoms of their condition.

Today the dividing line is likely to be set also by ideas about indigenous Australians and asylum-seekers, but multiculturalism is still a leading status marker. ■

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Dr. Cairns is the University Distinguished Professor of Environmental Biology Emeritus at Virginia Polytechnic Institute and State University at Blacksburg, Virginia.

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Canada: Its Troubles Continue

by Mark Wegierski

This July 1st, Canadians celebrated the 135th anniversary of Confederation, the founding of the Canadian polity (1867). Most Americans pay little attention to Canada, which is often seen as a sage, friendly country, with vast expanses of forest and prairie, which is the United States' closest but unobtrusive neighbor. However, it could be argued that Canada has, in the last few decades, become an increasingly troubled country.

Canada is today probably the world's most "post-modern" (or "hypermodern") society. The old British roots of Canada were thoroughly abandoned after the 1960s, especially under the leadership of Pierre Elliott Trudeau, who was Prime Minister (representing the left-leaning Liberal Party) from 1968-1984 (except for nine months in 1979-80). Trudeau imposed his left-liberal vision on the country as a whole, especially through the imposition of the Charter of Rights and Freedoms (1982), on the hitherto far more traditional Canadian constitutional system. The Charter was the culmination of Trudeau's social revolution, which entrenched virtually the whole left-liberal agenda as the highest law of the land. Canada evolved in ever more left-liberal directions after Trudeau's departure, despite the 1984 landslide election victory of Brian Mulroney (representing the Progressive Conservative party), and supposedly the voice of "the Right" in Canada. Since Mulroney almost totally abandoned "small-c conservative" principles, there emerged in 1987 Preston Manning's Reform Party, as a voice of right-wing protest. Although under almost continual attack by left-liberals, the Reform Party won 52 of 295 seats in the Federal Parliament in the 1993 election; and 60 of 301 seats in the 1997 election. Although Mulroney had won another term in 1988 on the basis of support for the Canada-U.S. Free Trade Agreement, the Progressive Conservatives were crushed in 1993, winning only two seats. The Liberals under Jean Chretien won a majority government in both the 1993 and 1997 elections.

In 1998-2000, the Reform Party transformed itself into the "more moderate" Canadian Alliance, electing a new leader, Stockwell Day. It could be argued that, in historical terms, the Canadian Reform Party itself was a fairly thin gruel for more substantive conservatives. It was much different from the U.S. Reform Party. In the 2000 election, the Canadian Alliance won 66 of 301 seats. The Liberals once again formed a majority government. In 2001, there occurred the wrenching revolt against Stockwell Day's leadership, which at one point attracted 13 Canadian Alliance M.P.s. The rebels were opposed to the supposed incompetence and extremism of Stockwell Day (those failings, of course, had been much magnified by a hostile media). Finally, there was a party leadership contest in 2002, which was won by Stephen Harper. The young and intellectually sharp Harper defines himself as a "classical liberal" – which means he can better deal with media accusations of being a "social reactionary" who "wants to impose his values on the country." However, he is certainly able to work with all the various right-wing groupings: economic conservatives, social conservatives, right-wing patriots, classical liberals, and libertarians.

In the twentieth century and today, Canada is characterized by the hegemony of the Liberal Party, and of left-liberal forces. Before the 1960s, although the Liberal Party was in power for most of the time, it was a decidedly more moderate party. The unending waves of social and cultural experimentation began under Liberal Prime Minister Lester B. Pearson (1963-1968), who replaced Canada's traditional flag, the Red Ensign (with its Union Jack), with the current-day flag, which many at that time saw as a Liberal Party

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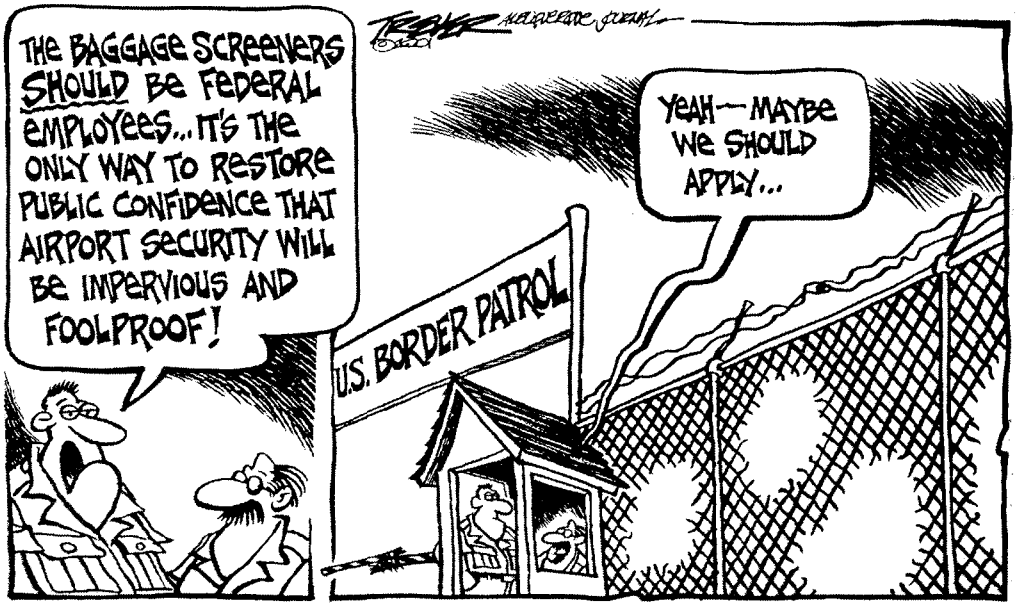
banner. This change of the flag was a symbol and call for further, massive transformation. Trudeau extended Pearson's enterprise in ever more directions. Mulroney was almost completely captive to Trudeau's ideas. The current Prime Minister of Canada, Jean Chretien, was a long-time associate and follower of Trudeau.

The main characteristics of current-day Canada are as follows. First, there is the program of multiculturalism, or what should really be called *multiracialism* – as "white ethnic" groups like Ukrainian, Italian, or Polish-Canadians have little influence. Second, there is the program of very high immigration, most of which comes from the Third World these days. Third, there is the program of ever more radical feminism. Fourth, there is the advancement of the gay rights agenda. Fifth, there is the program of very extensive support for aboriginal peoples. As of 2001, over half of the population of Toronto (Canada's largest metropolis) were visible minorities. ("Visible minorities" is a term officially used in Canada.) The immigration inflow has (since 1988) been about a quarter-million persons a year. (The over-all population of Canada now is about 30 million people.)

The current-day situation in Canada is acceptable to most Canadians because it is to a large extent linked to a very generous welfare-state. There remains the question whether such a generous, over-extended welfare-state might not implode at some point, and be forced to increasingly cut its various services and benefits, presumably at the expense of those who do *not* currently have the coveted status of "designated groups" or preferred minorities.

It should also be added that Canada today lacks an effective military, fails to properly control and watch its borders, and that the Canadian dollar (lately trading mostly around 63 cents U.S.) has plummeted in relation to the U.S. currency. One could also raise the issues of widespread social decadence and a very high abortion rate. There is also the almost complete atrophy of a more vital intellectual and literary life, where political correctness reigns to a far greater extent than in the U.S.

Despite the comparatively high standard of living in Canada, "man does not live by bread alone." Looking at this tangled skein of various Canadian syndromes, it is be hoped that other Western and European countries, and especially the United States, might somehow be able to resist such a direction of development, which is hopefully only one of many different possible futures. ■


THE BAGGAGE SCREENERS SHOULD BE FEDERAL EMPLOYEES... IT'S THE ONLY WAY TO RESTORE PUBLIC CONFIDENCE THAT AIRPORT SECURITY WILL BE IMPERVIOUS AND FOOLPROOF!
YEAH — MAYBE WE SHOULD APPLY...
U.S. BORDER PATROL

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From Russia – But Not With Love

Book Review by Carl F. Horowitz

Anyone who doubts the Russians have superseded the Italians as the biggest, baddest ethnic mobsters in America might consider a recent film trend. In *Analyze This, Mickey Blue Eyes*, and *Corky Romano*, Italian gangsters emerge as likable bumblers who somehow get the job done, and we discover that underneath their rough exteriors beat the hearts of sensitive family men. The hit HBO series, *The Sopranos*, is hardly alone in its depiction of Sicilian crime families as endearingly dysfunctional like the rest of us.

Sensitivity, on the other hand, is not what comes to mind in encountering Russian mobsters in such movies as *Little Odessa, The Jackal,* and *Birthday Girl*. "Ugly" and "uglier" would be more accurate. The following comments by real-life, law-abiding Russian immigrants quoted by Finckenauer and Waring confirm this perception: "The Italian mafia is just more civilized." "I think that the Russian mafia is more cruel and more reckless." "In terms of structure, the Russian mafia is only bonded by the will to break the law to get the money. There is no respect to the boss as it is in the Italian mafia."

Every ethnic group has its own version of "the mafia," that deadly vortex where blood, money and violence converge. In the name of "protecting" the communities they prey upon, ethnic crime syndicates underscore Hobbes' main insight three and a half centuries ago: For self-governance to be possible, a nation must politically and morally overpower any and all of its warlord-run confederacies. For nearly thirty years, combining guile and intimidation, a confederacy of immigrant criminals from the former Soviet Union has infiltrated American life. While geographically disparate, its "capital" from the start has been the section of Brooklyn, N.Y. known as Brighton Beach, home to about 30,000 legal post-Soviet immigrants, and perhaps at least that many illegal ones. Another 40,000 to 50,000 immigrants are clustered in communities elsewhere in the New York City metropolitan area, and hundreds of thousands more live in other areas of the country. Whether in the U.S. or back home – many commute as sojourners between the two worlds – these criminals have honed their talents in such fields as diamond-smuggling, fuel-tax evasion, drug trafficking, extortion and money laundering, not to mention terrorizing or killing anyone who might complain about such things.

Russian Mafia in America: Immigration, Culture, and Crime
by James O. Finckenauer and Elin J. Waring
Boston: Northeastern Univ. Press
320 pages, $18.95 paper

Red Mafiya: How the Russian Mob Has Invaded America
by Robert I. Friedman
Boston: Little, Brown
296 pages, $25.95

These two books, though using radically different approaches, effectively tell the story of how this underworld came to amass so much clout. Each treats the reader to a gallery of rogues, describing in detail how these criminals operate, including the alliances they make to stay ahead of police and prosecutors. The books, though unwittingly, serve as scathing critiques of our overall immigration and refugee policies.

James Finckenauer and Elin Waring's *Russian Mafia in America* is an update of their original 1998 work. The authors, respectively a criminologist at the National Institute of Justice and a sociologist at City University of New York, pored through records of the Tri-state Soviet Émigré Organized Crime Project, a

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joint venture of New York, New Jersey and Pennsylvania crime commissions. They also conducted questionnaire surveys of more than four hundred U.S. law enforcement agencies, interviewed police officers in Russia and (former Soviet) Georgia, interviewed immigrants here, analyzed indictments and trial transcripts, and collected virtually every book, report, and article on the subject of Russian organized crime.

"Russians were socialized into an environment that rewarded scheming and scamming..."

Finckenauer and Waring reiterate their original conclusions about the Russian Mafia: it isn't Russian and it isn't a mafia. As for the first, "Russian" is shorthand for the farrago of nationalities that had been part of the Soviet Union. Russia sent the most immigrants here, not surprisingly, but Ukraine, Georgia and Uzbekistan also have exported sizable shares. More importantly, these crime syndicates should not be considered a mafia, since they operate in a much different manner than the Sicilian Mafia (though the two sometimes collaborate). Russian mobs, they observe, unlike La Cosa Nostra, lack centralized hierarchies of bosses, *capos* and loyal cadres of "made men." Nor do they have settled ways of recruiting and initiating members, or resolving grievances. The Russians instead have formed loose networks whose members shift loyalties in response to opportunities to make money, a reality underscored by the authors' vertigo-inspiring flow charts. Because they do not operate as families but as large informal networks, Russian mobsters are more apt to act on impulse, knocking off rivals without prior approval from the top.

But the extra dose of ruthlessness of the Russians has at least two other sources. For one thing there is the nature of the Soviet system they left behind. The Soviet Union, to say nothing of Russia today, was shot through with corruption from top to bottom. Everything from school admissions to court justice to decent apartments could be bought with a bribe. Indeed, in many cases such things *had* to be bought this way since the black market often formed the bulk of what passed for an economy. Soviet citizens came to believe that bribery was a morally legitimate way of circumventing the inability of the official economy to deliver on its promises, especially as Soviet officials themselves winked at, and participated in, scams. Knowing cynicism ran rampant; sociopaths in the criminal underworld knew they had a field day recruiting new members. "Growing up in the Soviet Union," the authors note, "Russians were socialized into an environment that rewarded scheming and scamming and penalized playing it straight. They were taught to do whatever they had to do to survive."

A second reason for the Russians' barbarism is the persistence of a centuries-old criminal brotherhood known as the *vor v zakonye*, literally, "thieves-in-law." Hard-core felons, one and all, members are required to take an oath never to work at a legitimate job, pay taxes, fight for the military, or cooperate with the police or state officials unless the purpose is to trick them. They communicate in code, and set up communal funds to bribe officials, finance criminal ventures and help family and friends. These are the people who taught Lenin's revolutionaries how to rob banks. They eventually turned against the Soviet government, especially since so many of them had done time in gulags under Stalin (do not weep for them – they terrorized their fellow inmates). Standing out among millions of Russian thieves and robbers, the *vor* is an elite unit, akin to first among equals as opposed to crime bosses.

Both books, especially Robert I. Friedman's *Red Mafiya*, tote up the damage done by criminals who were not going to work for chump change. America provided opportunities for scams and shakedowns these people could only dream about back home. Two common sources of early wealth were shaking down small businesses and pocketing gasoline tax money through an elaborate network of phony distributorships. Physical force is crucial. By the end of the 1990s, Friedman noted, about eighty Russian mob-related murders in Brooklyn alone had remained unsolved. The sheer reach of the networks is overwhelming. Even in the early years of the migration, Friedman notes, nearly every Russian in Brighton Beach had a family member who was either

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connected to the mob or paying off an extortionist. This reflects a classic pattern of immigrant groups to the U.S., generally, that criminologists call the "crooked ladder of opportunity," whereby people not involved in crime in their country of origin become involved *after* their arrival here.

Friedman, a journalist who, sadly, died of natural causes this past July, knew first-hand the dangers these people present. He interviewed several kingpins, and received a written death threat from one of them, Vyacheslav Ivankov, and a $100,000 contract murder-for-hire offer from another, Semion Mogilevich, whom the CIA calls "the world's most dangerous gangster." While Friedman lacks the systematic rigor of Finckenauer and Waring, he conveys with greater effectiveness just what an oily collection of sociopaths these principals really are. Marat Balagula, Boris Nayfeld, Ludwig "Tarzan" Fainberg, and Monya Elson may not have the reputations of mafia dons in the American public mind, but they are every bit as obsessive in amassing raw power, and mowing down anyone who stands in their way. Putting these people behind bars is far easier said than done as long as witnesses see safety in silence. "You can't work a homicide in Brighton Beach," noted a local precinct detective quoted by Friedman. "The Russians don't talk. Someone could get whacked in a club in front of a hundred diners, and nobody would see anything. So they will kill with impunity." Fitfully, these and other gangsters are convicted and do prison time (sometimes in Israel, a favorite destination), but the FBI and other law enforcement officials are playing catch-up. When they get out, as in the case of Elson, they may emerge more brutal than ever.

The rise of the Ukrainian-born Mogilevich, the "Brainy Don," who could serve as the model for a James Bond villain, reveals just how high Russian criminal networks are aiming. He oversees a global communications network and hires a host of Ph.D.s skilled in encryption, finance, and other fields. It was he, federal authorities say, who engineered the Bank of New York's spectacular $7 billion money-laundering scheme that tarnished that institution in 1998. Russian organized crime may not yet be structured like La Cosa Nostra, but Mogilevich might be the man to change all that.

The ultimate issue is how so many of these people got into this country in the first place, and why they haven't been deported. The Finckenauer-Waring and Friedman volumes, informative and entertaining as they are, must be read as a warning of the consequences of misguided immigration and refugee policies. The initial impetus for the importation of Russian crime was the Jackson-Vanik amendment. Congress passed this 1974 Cold War legislation in an attempt to link U.S. trade benefits with emigration rights for Soviet Jews. Unfortunately, not simply persecuted Jews, but thousands of criminals as well, Jewish and non-Jewish alike, came here, including those whom the Soviet government chose to release from prison. Any number of nominally Jewish mobsters, such as Elson, entered the U.S. in the 1970s admitting that escape from persecution played no part in their decision to emigrate. The *glasnost* of the Gorbachev years, followed by the collapse of the Soviet Union, triggered a much higher influx, though often to areas outside Brighton Beach. The floodgates soon opened. In 1992, for example, nearly 130,000 non-immigrant (visitor) visas were issued to persons from Russia, Belarus and Ukraine; the 1988 combined figure for these nations was a mere 3,000. But many of these "guests" have yet to leave. Meanwhile, legal immigration (including those who obtained residence as refugees), after declining to near-zero levels by the mid-1980s, shot up to more than 100,000 annually, before declining again to modest levels by the late 1990s. Immigration authorities, already swamped, will be kept busy for many years finding and deporting the criminals among them.

American conservatives have displayed a remarkable naivete over the years in asserting that newcomers from formerly Communist countries, deep down, are American patriots. It takes more than opposition to Communism to constitute an understanding of the American idea. If Russian criminals love this country, it is in the same sense that Willie Sutton loved banks. "The Russians didn't come here to enjoy the American dream," Friedman quotes a New York State tax agent. "They came here to steal it." Having imported these thugs and thieves to our shores, we are in for a long battle to undo the damage, a task made all the more daunting in light of the reality that Islamic fundamentalist immigrants, legal and otherwise, now have first claim on our attention. ■

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The Lomborg Factor

Merry-go-rounds, teeter-totters, and cornucopian cataracts

Book Review by Craig A. Straub

One of the most popular news media hours, *The O'Reilly Factor*, promotes itself as operating in the "no spin zone." Bill O'Reilly, host of the news show, ends each hour with "the spin stops here." The promotion is a fair and balanced presentation of timely social issues with no tainted twists. This contemporary "no spin" approach is consistent with Garrett Hardin's proposal that complex issues are best understood by dividing the proficiencies produced by education, namely: literacy, numeracy and ecolacy. Hardin asserts that these proficiencies are filters for simplifying reality, allowing one to come closest to the truth by simultaneously using the three filters (Hardin, 1985). The literate, numerate and ecolate filters critically deal with words, numbers and ecosystems, respectively.

The Skeptical Environmentalist: Measuring the Real State of the World
by Bjørn Lomborg
Cambridge: Cambridge University Press
515 pages, $28.00

Lomborg, a Danish statistician and professor of statistics at the University of Aarhus in Denmark, is a one filter show, perpetually spinning within the world of numeracy, attempting to revive disciples of the late Julian Simon, who purport the world is getting better, without acknowledging that betterment is at the expense of the natural resource base. Simon was a University of Maryland business professor who generated controversy with simplistic contrarian views of environmental conditions. Following the ruts of Simon, Lomborg attempts to measure the real state of the world through interpretation of environmental data. The misuse of data is packaged in 352 pages of text and 81 pages of footnotes to denounce the environmental community as being cynical and unrealistic for warning of ecosystem collapse.

Lomborg fails to discuss general problems when dealing with data, how to differentiate between good and bad, the failure of those collecting and disseminating information, and uncertainty. Vast quantities of environmental data are available with varying quality.

Selectively using data, one could support almost any conclusion. Lomborg selects data which support his position and ignores the rest. He relies on data showing improvements in rich countries and does not acknowledge evidence about conditions in developing countries. "The number of hours we work has been halved during the last 120 years, and because we live ever longer than we used to, we have more than twice as much leisure time to enjoy" (Lomborg 2001, p.87). The "we" referred to is the population of the developed world. The population of the developing world is not acknowledged.

Lomborg concludes that sufficient water resources exist (Ibid., p. 150) based upon computing the total amount of freshwater theoretically available, per person, on a global average. This statistic is irrelevant to the complexity and severity of problems related to local and regional access to water. Lomborg confuses the differing concepts of water consumption, water withdrawals, water availability, access to water, and water use, which further confuses his analysis (Ibid., p. 150). His confusion between "availability of water" and "use of water" leads to the conclusion that 96 percent of all nations presently have sufficient water resources (Ibid., p. 154). This contradicts the finding that more than one billion people lack access

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to clean drinking water and 2.4 billion people lack access to improved sanitation services (World Health Organization, 2001).

Lomborg indicates that the worlds' forests are not under threat. This is a flawed conclusion based on errors of omission. He indicates the most recent survey (Forest Resources Assessment, 2000) conducted by the United Nations Food and Agriculture Organization states that tropical forests are undergoing deforestation at a rate of 0.46 percent. The serious error stems from Lomborg reporting this figure as global percentage (global forest cover) rather than a regional percentage (tropical rain forest). The majority of forest clearing is occurring in the tropics.

"Lomborg is a statistician who ignores or does not understand ecology and as a result is unable to adequately assess the complexity of the world. His narrow, simplistic view of the world is a product of living in 'a spin zone.'"

Lomborg's decision to join the cornucopian camp taints his conclusions about the severity of environmental problems. He states, "The U.S. has only lost approximately 30 percent of its original forest area" (Lomborg 2001 p.112), a direct implication that this forest loss is an insignificant amount.

The author discounts the value of biodiversity and challenges scientific estimates of extinction rates. Lomborg provides an extinction rate of 0.7 percent over the next 50 years. This estimate is inconsistent with the literature which indicates that 10-40 percent of well-known species are close to extinction (TNC, 1996; Collar et. al, 1994; Baillie and Groombridge, 1996). He selectively omits a relevant paper which demonstrates that Simon's estimates of current extinction were three to four orders of magnitude lower than all other published extinction rates.

Lomborg presents the same flawed case histories as Simon. He asserts that the reduction U.S. eastern forests totaled 1-2 percent of the total original area, resulting in extinction of only one forest bird. The actual percentage of forest is close to 50 percent and the extinction of four bird species (Pimm and Askins, 1995).

Lomborg also rehashes the Puerto Rico Study, which was a correlation between rainforest and extinction of species. Lomborg summarizes the study as finding that 99 percent of the primary forest was reduced, resulting in more birds. However, evidence to the contrary indicates forest cover was reduced to 10 percent rather than 1 percent (Brash, 1987). In addition, the author ignores or does not understand that the additional species are invasive from other parts of the world, with no specificity for habitat requirements.

Lomborg dismisses the view that the expansion of human numbers is part of the population problem. He views the imbalance of people and resources as a local concept related to local support systems. Lomborg concludes that this imbalance can be rectified through international trade or migration to cities. However, he misses the fact that as population increases, so does the pressure on fisheries, forests, and croplands. The impetus for migration to cities is the idea that urban dwellers typically have higher standards of living than villagers. Migration to cities can result in appalling living conditions for villagers due to the inability of governments to accommodate rapid population growth with the necessary health services, education, and infrastructure.

Lomborg is a statistician who ignores or does not understand ecology and as a result is unable to adequately assess the complexity of the world. His narrow, simplistic view of the world is a product of living in "a spin zone." Lomborg's vision of the future is compatible with that of the environmental community: a world where children will live longer and be healthier, able to enjoy a higher standard of living by enjoying natural amenities without destroying the environment. The big difference is how the environmental community, and cornucopians like Lomborg, approach achievement of the vision. The

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environmental community takes a scientific approach: identify the problem, test the hypotheses, understand the complexity of the problem, and formulate solutions to the problem. Lomborg's approach is to affix the blinders, wish upon a star, and hope for the best. ■

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The Discipline of Power

Confronting chaos abroad and at home

Book Review by Mark Wegierski

This is the latest book by the social observer, world traveler, and prolific commentator, Robert D. Kaplan. It combines his extensive reading of ancient and early modern classics with his acute observations of the current-day world, to offer a succinct statement on international strategy that Western statesmen could follow in the twenty-first century and beyond.

Warrior Politics: Why Leadership Demands a Pagan Ethos
by Robert D. Kaplan
New York: Random House
198 pages, $22.95

The book is a continuation of Kaplan's extensive writings on the late modern world, which have included, *The Ends of the Earth: A Journey at the Dawn of the 21st Century* (1996) (reviewed in *The Social Contract*, Vol. VIII, No. 2 (Winter 1997-98), pp. 140-143); *An Empire Wilderness: Travels into America's Future* (1998); and *The Coming Anarchy: Shattering the Dreams of the Post Cold War* (2000) (reviewed in *The Social Contract*, Vol. XI, No. 4 (Summer 2001), pp. 292- 294).

In his preface Kaplan points to his perspective, which is that of an avid observer and reader, and longtime press reporter stationed overseas, rather than of a professional academic or government official.

The first chapter begins with the striking insight: "There is no 'modern' world." Kaplan argues that human nature, with its proneness to violence and selfishness, and the accumulated weight of history, does not really change.

In "Churchill's *River War*" Kaplan emphasizes that Churchill, as the defender of British imperialism and as Britain's heroic leader against Hitler, can only be seen as coterminous. "Both in the 1890s and fifty years later, Churchill's unapologetic warmongering arose not from a preference for war, but from ... a Victorian sense of imperial destiny – amplified by ...

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a rich historical imagination" (p. 25).

In "Livy's Punic War" Kaplan draws some realist conclusions from that ancient author: "Both the Second Punic War and World War II are episodes in an endless drama of momentous stakes, whose plot is never determined in advance and which we have the power to alter throughout, provided we believe in ourselves the way Rome did when challenged by Hannibal" (p. 37).

The fourth chapter looks at Sun-Tzu and Thucydides. From Sun-Tzu, Kaplan draws the wisdom that "...the strategic pursuit of self-interest is not a cold and amoral pseudo- science, but the moral act of those who know the horrors of battle and seek to avoid them" (p. 42). Kaplan also applauds Sun-Tzu's endorsement of espionage: "Good spies prevent bloodshed..." (p. 43).From Thucydides Kaplan draws the pragmatic wisdom: "Because humanity ... is divided into groups that are in incessant competition with each other, the central characteristic of all states is their maneuverability: rarely can states be categorized as strictly good or evil ... the acceptance of a world governed by a pagan notion of self-interest ... makes statesmanship likelier to succeed: it curtails illusions, reducing the scope for miscalculation" (p. 51).

"[The author]draws a distinction between the civilized "soldiers" of a power like America, and the ferocious "warriors" who are likely to constitute America's main opposition in the future."

The invocation of "pagan virtue" in Kaplan's book could be seen as somewhat esoteric. What is paganism typically linked with today, as opposed to Christianity? There are the ecological-pacifist pagans, but it may also be remembered that Nazism endeavored to create a debased, nasty neo-paganism. Kaplan's definition of "pagan" is relatively close to that celebrated by Alain de Benoist's eclectic, cultural, anti-capitalist Nouvelle Ecole, but in Kaplan's case, it is hoped to be deployed on behalf of Americanizing universalism (see below) rather than aiming toward a genuine planet-wide polycentrism or pluralism.

In Chapter V, Kaplan lays forth the concept of "Machiavellian Virtue." Although Kaplan admits that Machiavelli is to be approached with some caution, Kaplan also says there is much to recommend in Machiavelli's notion of "a morality of results rather than of good intentions" (p. 53). Kaplan writes: "...[t]he core of Machiavelli's wisdom is that primitive necessity and self-interest drive politics, and that this can be good in itself, because competing self-interests are the basis for compromise, while stiff moral arguments lead to war and civil conflict, rarely the better options" (p. 63).

Kaplan's sixth chapter, "Fate and Intervention" argues against excessive "determinism" – there is always individual action to be considered as opposed to "vast, impersonal forces" – and unusual things can happen. At the same time, the interventions of the West must be carefully thought out, and will always have to be selective.

Chapter VII looks at Hobbes and Malthus. From Hobbes, the lesson is drawn that order and security, rather than freedom, may be the most basic human need. As for Malthus, he is "the first philospher to focus on the political effects of poor soils, famine, disease, and the quality of life among the poor" (p. 97) and is seen as having "defined the most important debate of the first half of the twenty-first century. As the human population rises from 6 billion to 10 billion before it is predicted to level off, testing the planet's environment as never before – with a billion people going to bed hungry and violence (both political and criminal) chronic throughout poor parts of the globe – the word "Malthusian" [Kaplan's emphasis] will be heard with increasing frequency in the years to come" (pp. 97-98).

In the chapter on "The Holocaust, Realism, and Kant," Kaplan points to German philosopher Immanuel Kant as a figure whose liberal idealism is needed to keep the realist outlook in some perspective. Kaplan writes: "...a statesman must employ the

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wisdom of ... other philosophers in order to reach the goals outlined by Kant" (p. 113).

Chapter IX, "The World of Achilles: Ancient Soldiers, Modern Warriors" draws a distinction between the civilized "soldiers" of a power like America, and the ferocious "warriors" who are likely to constitute America's main opposition in the future. Following Michael Lind, Kaplan argues that the world will have to be ordered more by an "age-old model based on an ancient code of honor" rather than by "international law" (p.131).

The chapter "Warring States, China and Global Governance" points attention to that period of Chinese history (with multiple centers of power) that eventually led to a unified Chinese Empire, as a possible precursor of what might occur in our own global future. Kaplan clearly states that America is central to this process. "American patriotism – honoring the flag, July Fourth celebrations, and so on – must survive long enough to provide the military armature for an emerging global civilization that may eventually make such patriotism obsolete" (p. 145). In the end, "*We and nobody else will write the terms for international society.*" [his emphasis] (pp. 145-146). The astute reader might perceive here a rather unexpected convergence between Kaplan's realism grounded in ancient and early modern classics and the democratic triumphalism of the first-universal-nation crowd. Is the main difference only that Kaplan wants to carry out this process of global democratic revolution in a careful, deliberate, *smart* way?

At the end of his book, Kaplan indeed offers an olive branch to liberals and neoconservatives that seems to partially undermine some of his earlier arguments: "The United States is nothing without its democracy; it is the homeland of freedom rather than of blood. But to deposit judiciously its democratic seeds in a wider world that is closer and more dangerous than ever before, it will be compelled to apply ideals that while not necessarily democratic, are worthy nonetheless. *The more respect we have for the truths of the past, the more certain our journey away from it*" (p. 155) (reviewer's emphasis). So we must be tougher in foreign policy today for the sake of a brighter, "democratic" future – which some might see as simply another utopian fantasy.

Kaplan's suggestions for foreign policy and geo-strategy are certainly invigorating, but they seem to ignore the domestic front, where many of the phenomena described by Kaplan (such as mass migration, tribalism and ethnic chaos) are becoming increasingly salient. What Kaplan openly calls the "multiethnic American imperium" (p. 145) – although it does wield vast military force – increasingly comes to lack many of the characteristics of a truly cohesive society. Sometimes, the absolute confidence and belief in one's own cause of a reckless or very committed few can significantly challenge the massive infrastructures of a society consumed by self-doubt and craven weakness. Only a return of Western and European self-confidence and the truly heroic can ensure the continued existence of those societies, which are today so thoroughly guilt-ridden and self-effacing. Internal or so-called vertical barbarians are probably more dangerous than the external ones. The notion of "warrior politics" which Kaplan advances thus clearly has domestic as well as foreign policy implications. ■

ILLEGAL IMMIGRANTS

Here are the Census Bureau's figures on the 8,705,421 illegal aliens residing in the United States in the year 2000, listed by place of birth.

North and Central America	**5,312,990**	**Europe**	**1,113,683**
Mexico	3,871,912	Asia	1,363,419
Cuba	216,297	Middle East	114,818
Dominican Republic	17,942	Iran	30,823
El Salvador	336,717	Israel	24,372
Guatemala	238,977	China (including Taiwan)	226,886
Canada	156,231	India	200,306
Haiti	48,003	Japan	118,357
Jamaica	37,666	Korea	182,621
South America	**624,419**	**Africa**	**243,342**

From the Washington Times, January 23, 2002

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The Bulletin Board

Immigration on the Internet

THE SOCIAL CONTRACT journal now has a research site by which all the articles published in previous issues of the journal are available at <www.thesocialcontract.com>.

Below are some additional sites that readers may find of interest. Listing them here does not imply that THE SOCIAL CONTRACT endorses the material on any specific site.

- The Federation for American Immigration Reform (FAIR): www.fairus.org.
- Immigration by the Numbers: www.numbersusa.com.
- ProEnglish: www.proenglish.org.
- A new voice for population/environment issues: www.sprawlcity.org.
- Center for Immigration Studies: www.cis.org.
- *Limits to Growth* edited by Brenda Walker: www.LimitsToGrowth.org.
- Alternatives to Growth Oregon at: www.agoregon.org.
- Affirmative Action for Immigrants: www.pw2.netcom.com/~jimrobb.
- Comments from Peter Brimelow, Joseph Fallon, and others: www.vdare.com.
- News and commentary on ethnic and other conflicts worldwide: www.antiwar.com.
- Carrying Capacity Network: www.carryingcapacity.org.
- Negative Population Growth: www.npg.org.
- California Coalition for Immigration Reform: www.ccir.net.
- Philip Martin's *Migration News:* www.migration.ucdavis.edu.
- Professor Norman Matloff: www.heather.cs.ucdavis.edu /pub/Immigration/Index.html.
- Midwest Coalition for Responsible Immigration: www.enteract.com/~mcri97.
- Sierrans for U.S. Population Stabilization: www.susps.org.
- *People and Place* is published in Australia by the Centre for Population and Urban Research: www.elecpress.monash.edu.au/pnp.
- Canadian Immigration Reform Committee: www.canadafirst.net.
- Voices of Citizens Together: www.americanpatrol.com.
- Council of Conservative Citizens: www.cofcc.org.
- Columnist Samuel Francis: www.samfrancis.net.
- The Biocentric Institute: www.iapm.org/biocenter.html.
- Stalking the Wild Taboo: www.lrainc.com/swtaboo/.
- ProjectUSA: www.projectusa.org.
- The European Forum for Migration Studies: www.uni-bamberg.de/~ba6ef3/home.html.
- Floridians for a Sustainable Population: www.flsuspop.org.
- Population and Sustainability: www.ecofuture.org/populat.html.
- American Renaissance: www.amren.com.
- *Mankind Quarterly:* www.mankind.org.
- Federal Publications (developments in immigration law): http://www.fedpub.com/fedpub/immigrat.htm.

E-mail addresses for pertinent organizations:

- Center for Immigration Studies (CIS): center@cis.org.
- Negative Population Growth: npg@npg.org.
- Carrying Capacity Network: ccn@igc.apc.org.
- Californians for Population Stabilization (CAPS): caps@cap-s.org.

And from the perspective of the opposition and their stand for open borders:

- The American Immigration Lawyers Association: www.aila.org.

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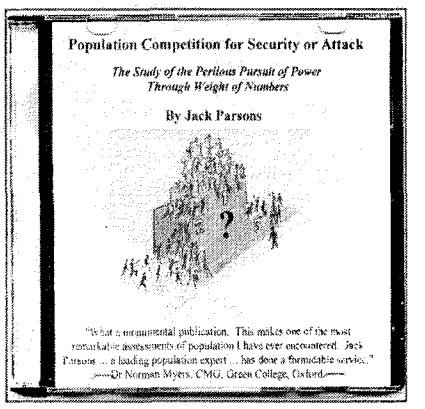
Human Population Competition

A Study of the Pursuit of Power Through Numbers

by Jack Parsons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The Study of the Perilous Pursuit of Power Through Weight of Numbers
By Jack Parsons
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—Dr Norman Myers, CMG, Green College, Oxford—

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>
> – G. McNicoll, Senior Associate, Policy Research Division, Population Council, New York; Professor, Demography Program, Australian National University, Canberra

Jack Parsons' earlier works include the widely admired *Population Versus Liberty* (1971, UK and 1973 U.S.), and *Population Fallacies*, (1977, UK).

In 1998, Parsons, who in retirement is Visiting Lecturer at the David Owen Population Center at the University of Wales at Cardiff, published the culmination of his extensive research in a two-volume work, *Human Population Competition*. At a cost of $225 for the hardcover books the information was not as widely available as it ought to be. Now, through advancements in publishing technology, the full text, newly revised, is available on one compact disc. This may be the first time that a large, serious work on issues of vital concern is available on CD – and in a form that enables the reader to search rapidly on any topic of interest.

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